IFG

Institute for Research on Educational Finance and Governance

SCHOOL OF EDUCATION   STANFORD UNIVERSITY

Program Report No. 85-B4

INFLUENCE OF MICROELECTRONICS ON EMPLOYMENT IN JAPAN

Ken'ichi Sotoo
Hiroyoshi Ito

November 1985

Ken'ichi Sotoo is professor of law at the University of Tohoku. Hiroyoshi Ito is professor of International Labor Relations at the Miyagi University of Education.

The research for this report was supported by funds from the National Institute of Education (Grant No. NIE-G-83-0003). The analyses and conclusions do not necessarily reflect the views or policies of this organization.

INSTITUTE FOR RESEARCH ON EDUCATIONAL FINANCE AND GOVERNANCE

The Institute for Research on Educational Finance and Governance is a Research and Development Center of the National Institute of Education (NIE) and is authorized and funded under authority of Section 405 of the General Education Provisions Act as amended by Section 403 of the Education Amendments of 1976 (P.L. 94-482). The Institute is administered through the School of Education at Stanford University and is located in the Center for Educational Research at Stanford (CERAS).

The research activity of the Institute is divided into the following program areas: Finance and Economics; Politics; Law; Organizations; and History. In addition, there are a number of other projects and programs in the finance and governance area that are sponsored by private foundations and government agencies which are outside of the special R&D Center relationship with NIE.

Abstract

This paper reviews the state of progress of technological innovation based on microelectronics in Japan. The introduction of microelectronics has been accepted in Japan with relatively little resistance as something following in a direct line of progression from the technological innovations which began at the end of the 1950s, for a variety of reasons. In studying the influence of the introduction of microelectronics equipment on employment, the research considers both the qualitative and quantitative aspects as they affect employment. Even though microelectronics has thus far not had any serious impact on employment, such as by causing unemployment, changes in the makeup of the labor force in companies and changes in hiring point to the existence of rather serious problems. The introduction of microelectroncs equipment is having a many-sided impact on employment even in Japan, where it is said that it has moved ahead relatively successfully.

Table of Contents

Chapter 1. Introduction
- I. Definitions of Terms
- II. The First Period of Technological Innovations
- III. Movement to Raise Productivity
- IV. Labor-Management Consultation System
- V. Labor and Management Attitudes towards the First Period of Technological Innovations
- VI. Development of Microelectronic Technologies
- VII. Influence of Introduction of Microelectronics on Employment

Chapter 2. State of Introduction of Microelectronic Devices
- I. Factory Automation
- II. Office Automation

Chapter 3. Influence of Microelectronics on Employment
- I. Changes in Numbers of Workers in the Workplace
- II. Changes in Size of Places of Business and in Numbers of Workers in Businesses as a Whole
- III. Adjustment of Surplus Personnel Accompanying Labor-Saving Measures
- IV. Changes in Hiring
- V. Changes in Composition of Workforce
- VI. Safety and Hygiene

Chapter 4. Vocational Training
- I. On-the-Job Education and Training
- II. Public Vocational Training
- III. Education in the Schools

Chapter 5. Attitudes of Labor Unions
- I. Characteristic Features in Japan
- II. Results of Surveys on Attitudes of Labor Unions
- III. Concrete Examples of Labor-Management Agreements

Chapter 6. Conclusion

Chapter 1. Introduction

I. Definitions of Terms

Microelectronics (ME) at first referred to the technologies for manufacturing integrated circuits (IC), but with the subsequent progress of semiconductor technologies there appeared large-scale (LSI) and very-large-scale (VLSI) integrated circuits. As microprocessors (central processing units [CPU] of large-size computers using LSIs) and microcomputers (computers using LSIs, not only in their CPUs, but also in their memory and input/output circuits) were developed, the word "microelectronics" came to be used in a broad sense, not confined only to the manufacturing technologies for integrated circuits, but also including their application technologies. The technological innovations brought about by microelectronics in this sense are generally called in Japan "introduction of microelectronics" (ME-ka).

II. The First Period of Technological Innovations

Microelectronics technologies basically follow in a straight line from the technological innovations which began during the latter half of the 1950s. The technological innovations of that period were based on automation and aimed at high-speed mass-production of identical products. For example, transfer machines were used in the automobile industry, process automation in the petrochemical industry, and strip mills in the steel industry. Naturally, therefore, it was possible to introduce technological innovations based on automation only in large companies in the heavy and chemical industries in which production continued without interruption for prolonged periods and immense funds could be profitably invested in plant equipment. Of course, one must point out here that assistance was available on the basis of the government's positive economic policies, which centered the postwar economic reconstruction around the heavy and chemical industries. Paradoxically, the wartime destruction also created favorable external conditions in the sense that the latest types of factories could be built, not by a policy of "scrap and build", but literally from zero, since the existing factories had been destroyed in the war. Japan's natural conditions also had a favorable meaning for the country, since Japan is an island nation surrounded by oceans, lacks natural resources, and must depend on imports for its raw materials. These conditions were favorable for the country because industrial areas could be constructed along the coastlines in locations convenient for importing and exporting. Local governments also adopted positive measures to attract industrial plants. As a result, coastal industrial areas centering around the heavy and chemical industries were born in various localities; and they created the basis for the country's subsequent high rate of economic growth.

III. Movement to Raise Productivity

As another element further promoting these technological innovations, one must point to the movement aimed at raising productivity since 1955.

When Japan concluded the Peace Treaty and began to move along the road towards economic independence, the country was faced with an inevitable requirement. That is, in order to rebuild its economy, and especially to improve the standing of the Japanese economy in international trade, it was necessary for Japan to adopt positively the technological innovations which were then under way on an international scale and to attain improvements of productivity. For this reason, the Japan Productivity Center was established in February 1955. The government also adopted a "Cabinet Decision on the Movement to Raise Productivity" (September 1954) and took a totally supportive attitude towards the activities of the Japan Productivity Center. A Productivity Liaison Conference was established for the sake of promoting liaison and coordination between the government and the Japan Productivity Center. At its first meeting, the Conference adopted the following three basic principles concerning the movement to raise productivity:

"1. Improvement of productivity, in the final analysis, increases employment, but with respect to employees who become superfluous during the transition period, the government and private industry shall collaborate, from the viewpoint of the national economy, to take suitable measures such as transferring in order to prevent unemployment as far as possible.

"2. Labor and management shall collaborate concerning concrete measures for improving productivity. They shall study such measures in accordance with the actual conditions in each company.

"3. The results achieved by improving productivity shall be distributed fairly to management, labor and the consumers in accordance with the actual conditions of the national economy."

Inheriting the above basic principles, the Japan Productivity Center first took up the task of disseminating the system of labor-management consultation. According to the views of the Japan Productivity Center, labor-management problems under technological innovation "are not confined to the classical 'slicing of the pie' (distribution of the results achieved), but have expanded to problems dealing with 'enlarging the pie' (improvement of productivity)." Therefore, the "enlargement of the pie itself" must be dealt with "consciously and co-operatively by labor and management" by means of "rational, reasonable consultations in an arena where there is equality between labor and management, based on the labor-union organizations."

The Japan Federation of Employers' Associations (Nikkeiren) had participated from the beginning in the establishment of the Japan Productivity Center, and it was only natural that it should express its agreement with this movement to raise productivity. However, the General Council of Trade Unions of Japan (Sohyo) adopted an attitude opposing the movement ("Basic Attitude towards Intensification of Productivity," March, 1955), arguing that improvements of productivity and rationalization of companies would result in intensification of labor and increased labor accidents, disease and unemployment and that the burden would finally be imposed on the workers. However, the Japanese Confederation of Labor (Sodomei) adopted an attitude of conditional approval under the following basic principles: "(1) The movement to raise productivity, unlike individual rationalization movements and efficiency-raising movements, is a movement informed by a comprehensive policy aiming at attaining independence for the Japanese economy and at improving the national livelihood. (2) The movement to raise productivity does not aim to increase business profits by intensification of labor; rather, it aims to improve working conditions and improve real wages. (3) The movement to raise productivity must take effective measures to stabilize employment through expansion and development of the economy." In accordance with these principles, Sodomei adopted the following attitude: "(1) We absolutely reject personnel cuts under the name of the movement to raise productivity; in the event that surplus personnel should occur as a transitional phenomenon, such personnel shall be transferred under the condition that this shall not lead to any deterioration of their working conditions. (2) Management conferences shall be established in companies for the sake of democratization of management and of establishing industrial democracy; these conferences shall be utilized, and efforts shall be made to organize on their basis nation-wide labor-management conferences by business categories, by industries and by regions." (Decision of the Second Meeting of the Sodomei Central Committee, June, 1955).

IV. Labor-Management Consultation System

Even though the Sohyo-affiliated unions had adopted an attitude opposing the movement to raise productivity, they were obliged to take some measures to fend off the sparks of the technological innovations as they actually proceeded. A system of prior consultations came about as a result of this. The system of prior consultations with respect to technological innovations began with a long-term planning agreement concluded in 1955 between Mitsui Mining Co., Ltd. and Sankoren, a union belonging to the Japan Coal Miners' Union (Tanro). At a time when legislation concerning temporary measures to rationalize the coal-mining industry was introduced into the Diet, and rationalization of that industry became inevitable, Sankoren opposed the company's restructuring plan, which consisted chiefly of measures to cut personnel, to improve efficiency of coal production, and transfers. The long-term planning agreement which was concluded had the following general contents: (1) Full employment of union members was confirmed as the basic consideration, and the company would consult with the union in determining the fundamental principles. (2) Since changes in working conditions were expected to result from implementation of the company's long-term plan, these matters were to be deliberated concretely between the company and the union at each mine. An agreement on mechanization and a prior consultation agreement were concluded in 1958 on the basis of this long-term agreement. The mechanization agreement did not take the position of absolute opposition to mechanization itself, but it did require the company to promise that it would not fire workers or transfer them compulsorily as a result of mechanization and that it would not lower their working conditions. In the prior consultation agreement, the company promised that it would consult in advance with the union concerning plans for mechanization and rationalization and that it would not implement rationalization measures without the union's understanding.

In the unions in the public sector as well, chiefly in the All-Japan Telecommunication Workers' Union (Zendentsu), prior consultation agreements came about as a result of union struggles against rationalization. For example, Zendentsu obtained an "Agreement on Transfers and Other Matters Incident upon Mechanization of Telegraph Offices" in 1955. This agreement was followed in 1956 by a supplementary "Agreement on Transfers," and there was still another agreement in 1957 on "Basic Items of Understanding on Labor Conditions, Etc. with Respect to Progress in Rationalization." These agreements established clearly that, although plans for expanding and consolidating telecommunications were basically to be formulated and implemented by the Nippon Telegraph and Telephone Public Corporation on its own responsibility, nevertheless rationalization due to the introduction of new technologies during this process would have a direct or indirect influence on employment and other labor conditions of Public Corporation personnel. Therefore, the agreements provided that there would be prior consultations in the sense of preventing friction. The agreements stipulated that "plans for installing equipment having a bearing on labor conditions, and especially on personnel matters," were to be submitted to the union in advance and consultations were to be held about them at a stage where changes could still be made in the plans. The Japan Monopoly Corporation also concluded a "Memorandum on Prior Consultation about Mechanization, Etc." in 1958, and the Japanese National Railways concluded its "Articles of Basic Understanding Concerning Implementation of the JNR Modernization Plan" in 1957.

Sohyo announced in 1961 its "Guiding Principles in the Struggle against Rationalization," in which it summarized its thinking about the prior consultation systems such as those described above into which its member unions had entered. According to this, Sohyo was basically opposed to the current rationalization moves because they consisted essentially of measures for intensifying exploitation in a planned and long-term manner. However, the document emphasized the necessity of prior consultation systems, arguing that it would be impossible for unions to establish systems for waging advantageous struggles opposing rationalization plans unless the unions were able to discover the contents of such plans in advance. That is, the document stated clearly that the purpose of prior consultation was to discover in advance the rationalization plans of capital so that efforts could be aimed at changing, postponing or cancelling plans which were disadvantageous to labor. It also pointed out that, unless the prior consultation system was backed up by powerful collective bargaining rights and dispute rights on the union side, there was the danger that it might turn into an agency for persuading unions to accept rationalization.

V. Labor and Management Attitudes towards the First Period of Technological Innovations

At any rate, although the labor unions did not abandon their attitude of opposition or caution towards the technological innovations which began in the 1950s, they nevertheless, through the prior consultation system, concluded agreements whose provisions included that (1) there would be no firings, (2) stability of employment would be assured by measures such as transfers of surplus personnel, and (3) considerations would be incorporated to prevent deterioration of working conditions. Thus, in the final result, the unions accepted these technological innovations. Of course, since Japanese labor unions are organized on a company-wide basis, they find themselves in a situation where unions must in the final analysis accept technological innovations. Since a union's existence is based on the company, the union must do this in order to enable the company to survive and emerge victorious from intense competition with other companies in the same industry. For this reason, the unions placed the main emphasis in their struggles on lessening, however slightly, the disadvantageous impact of technological innovations on the workers. Even though the prior consultation system was started by the unions for the purpose of catching advance information, the system was able to play a role of providing sufficient information to the unions and of facilitating communication between labor and management.

Management also remembered its own bitter experiences immediately after the Second World War, when business consolidations and personnel cuts had occasioned violent strikes and measures taken for the sake of corporate survival had, on the contrary, threatened the very existence of the companies. It knew from these bitter experiences that it must avoid at all costs firings resulting from rationalization. Since co-operation of the workers was an indispensable element in the introduction of new production equipment based on technological innovations, personnel cuts were hardly compatible with the introduction of new machinery and modes of production requiring labor co-operation. Employers adopted a policy of gradual attenuation of surplus personnel resulting from technological innovation, in which they would not hire new employees and would not replace employees retiring at the age limit or at their own request. When redundant skilled workers were transferred, employers made efforts to find positions for them where they could make use of their past skills with little change. For instance, they tried to assign them to sections for prototype manufacturing, maintenance or repairs within the same plant; and workers who were removed from standard production sections were transferred to custom manufacturing sections. Attempts were also made to adopt a slow-moving, gradual approach to dealing with the problem of adapting to technological innovations. For example, even though there were differences in their productivity, new and up-to-date plants were operated simultaneously with old plants, the latter being used for manufacturing smaller lots of products with a higher added value.

One may say that the attitudes adopted by labor and management towards the technological innovations which began at the end of the 1950s have been basically inherited by both of them in their attitudes towards the introduction of microelectronics today.

VI. Development of Microelectronic Technologies

Phenomenal developments have been achieved in electronics as it has moved from the vacuum-tube period to the period of the transistor and then has entered the period of the integrated circuit (IC), in which electronic circuits themselves are located on semiconductor chips. The IC generation, which started in 1965, was succeeded in 1970 by the generation of the large-scale integrated circuit (LSI) and in 1980 by that of the very-large-scale integrated circuit (VLSI). For example, while a vacuum tube or transistor each consists of one element, the number of elements increased to 30 to 50 in an IC, 1,000 to 10,000 in an LSI, and to several million in a VLSI. If we translate this into the number of parts fitting within a 10-cm square cube, the number is four or five in a vacuum tube or up to 150 in a transistor, but the comparable number is said to be five million in an IC, 100 million in an LSI, and anything ranging from several billions to as much as ten billion in a VLSI [1]. Thus, the latent possibilities have been expanding limitlessly in scope, while the external sizes have been decreasing limitlessly. There have also been phenomenal improvements in memory capacity. Vacuum tubes and transistors had a memory capacity of 1 bit or less, while the capacities have been increased to 10 bits in ICs, 4,000 bits in LSIs, and several million bits in VLSIs. On the other hand, prices have been dropping year by year to an astonishing degree [2].

Supported by these phenomenal advances in IC technology, microcomputers have been developed and have been incorporated in all kinds of machine products, where they display their characteristic features: compact size, light weight, inexpensive price, high flexibility and wide applicability. They have spread rapidly into all areas of manufacturing, the economy and social life [3].

---

(1) Ministry of Labor, Project Team on ME, "Introduction of Microelectronics (ME) and Trends in Labor Policy" (July, 1983), p. 2.

(2) According to the Ministry of International Trade and Industry's "Yearbook of Machinery Statistics," if the average unit price of an IC in 1975 is taken as 100, the unit price in 1978 was 67%, that in 1980 was 60%, and that in 1981 was 55%. The price of one microcomputer (Intel, i-8008) imported into Japan in 1972 was ¥85,000, but as of 1983 such microcomputers were being quoted at prices close to ¥1,000. (Ministry of International Trade and Industry, Agency of Industrial Science and Technology, *The impact of technological innovation*, p. 45.)

(3) The government has taken positive measures to promote the semiconductor industry and the microelectronics equipment industry through assistance provided by the "Law for Temporary Measures to Promote Specific Electronics Industries and Specific Machinery Industries" ("*Kidenho*"), which was followed by the "Law for Temporary Measures to Promote Specific Machinery and Information Industries" ("*Kijoho*"). The latter law was enacted in 1978.

For example, in the manufacturing shop, machine tools are being replaced by numerically-controlled (NC) machine tools using LSIs, and there have appeared machining centers (MC), which may be called multi-functional NC machine tools which have a large number of exchangeable tools. They can perform various machining operations, automatically changing their tools for each operation. When equipped with computers, machines are endowed with the information-processing functions of the computers, and manufacturing systems composed of these machines have changed into systems capable of processing information. Large numbers of industrial robots have entered the factory, where they have automated a number of processes such as machining, assembling and inspecting. As these unattended FMS have expanded into factories, there have even appeared unattended factories.

At the same time, microelectronics has advanced into the office sector as well. Office work, which has been done manually for such a long time, has been gradually automated, mechanized and systematized by office information-processing equipment using microcomputers. Rationalization of office work began with the automation of accounting jobs. Eventually, non-numerical information such as documents, graphic and voice data have come to be processed comprehensively with various kinds of information equipment. Business machines, communication systems and data-processing systems have been compounded to create office automation (OA).

Needless to say, the aims of OA were to reduce personnel expenses, which made up the major part of office costs, and to improve the productivity of office work. However, in service businesses such as finance and distribution, the systems themselves are directly connected with sales of tangible and intangible goods and lead directly to profits. This has given additional impetus to the adoption of OA.

VII. Influence of Introduction of Microelectronics on Employment

Technological innovations brought about by the phenomenal advances of microelectronics have brought about qualitative changes in manufacturing and applied technologies. This is so because they have advanced widely into all fields regardless of the size of the industry or the company. Another reason is that, because of the constantly increasing speeds with which microelectronic technologies are developing, the effects of the introduction of microelectronics have appeared abruptly, rather than gradually. Moreover, the effects have appeared simultaneously in a wide range of different fields. The situation is one which really deserves to be called the "microelectronics revolution." The technological innovations centering around microelectronics are naturally exerting an important influence on employment, and these tendencies are being watched with deep interest in countries all over the world.

The purpose of this paper is to elucidate the impact on employment of the introduction of microelectronics in Japan on the basis of whatever survey materials are currently available.

Chapter 2. State of Introduction of Microelectronic Devices

I. Factory Automation

Let us use a survey by the Ministry of Labor ("Outline of a Survey Concerning Technological Innovations and Labor," August, 1983. Hereinafter referred to as Ministry of Labor Survey, "ME") to examine the state of introduction of microelectronics in the workplace in the manufacturing industries. The survey was carried out in November, 1982 of 10,000 privately owned places of business in the manufacturing industries which employed 100 or more permanent workers.

(1) In the manufacturing industries as a whole, 59.3% of all the places of business had introduced microelectronics devices (devices using integrated circuits) into their manufacturing processes, but of the places of business which had not yet introduced them at the time of the survey, 2.6% replied that they intended to do so within a year, and 6.6% replied that they intended to do so within two or three years. Consequently, one may assume that at the present time about 70% of the places of business have introduced microelectronics devices (Table 2.1).

(2) In Table 2.1 the percentages of places of business which have introduced microelectronics devices are classified by their sizes. Almost all (95.6%) of the places of business with 1,000 or more employees have introduced microelectronics devices into their manufacturing processes. The corresponding percentages are 77.1% for those with 300 to

999 employees and 51.2% for those with 100 to 299 employees. Thus, the percentage decreases as the size of the places of business becomes smaller. However, it is noteworthy that, even in companies with 299 or fewer employees, microelectronics devices have been introduced in about half of the places of business.

A survey made by the National Federation of Small Business Associations ("Introduction of Microelectronics in Small Businesses: Facts and Directions," March, 1984) also shows that microelectronics devices have been introduced in 48.2% of the companies with 51 to 100 employees, in 25.7% of those with 31 to 50 employees, and in 23.8% of those with 0 to 30 employees. 36% of the businesses surveyed also replied that they would introduce them in the future. It is clear that microelectronics devices are being introduced at a considerable pace in small businesses as well.

Table 2.3 shows when microelectronics devices were introduced into these places of business. 40.6% of the places of business introduced them between 1975 and 1979, and 28.3% of them introduced them during or after 1980 (until October, 1982, when the survey was made). Thus, nearly 70% of the total had introduced them after 1975, and it is clear that the move to introduce microelectronics has gone forward especially rapidly after 1975. As for the size of the companies, in the larger companies with 1,000 or more employees, about two-thirds of the places of business (41.7%) had introduced their devices between 1970 and 1974. On the other hand, most of the places of business with 300 to 999 employees and with 299 or fewer employees began to introduce the devices during or after 1975.

If we examine the state of introduction of microelectronics devices in different industries, we see that there are percentages of around 70% in four industries manufacturing machinery: general machinery (74.2%), transport machinery (72.6%), electrical machinery (71.5%) and precision machinery (68.4%), and also in the publishing and printing industries (69.2%). Other industries with high percentages of introduction of around 60% are the chemical, petroleum and coal industries (61.6%), the metal products industry (61.0%), the nonferrous metals industry (60.6%), the iron and steel industry (59.9%) and the furniture and accessories industry (58.9%). Other industries such as the foodstuffs and tobacco industries and the textile and apparel industries have percentages of about 40 to 50%. The lowest percentage is that of the lumber and wood products industry (36.5%). It is clear that introduction of microelectronics devices has spread widely throughout all of the manufacturing industries. (Table 2.2)

(3) When questioned about the reasons for introducing microelectronics devices, about two-thirds of the places of business mentioned "to save labor" (63.2%) and "to improve the quality and precision of products" (62.5%). This was

followed by the replies "to reduce costs of products" (33.2%) and "the prices became affordable" (9.8%). Only 4.6% replied "to deal with shortage of labor," and 4.1% replied "to improve the workplace environment." It is clear that the main motive leading them to introduce microelectronics devices was their desire to win out in cost competition with other companies.

This tendency can be seen equally well in large and small companies, although the percentage of places of business mentioning reasons such as "to improve the quality and precision of products," "the prices became affordable" and "to improve the workplace environment" tended to be higher among the larger-size businesses, while the percentage mentioning reasons such as "to deal with shortage of labor" and "asked by affiliated companies to introduce them" tended to be higher among the smaller-size businesses (Table 2.4). In on-the-spot surveys one often hears that many small businesses introduce microelectronics devices in order to solve their shortage of skilled labor and that many of them have been requested to introduce them by the parent companies to which they deliver their products in order to improve the quality. These results would seem to indicate that this can also be corroborated statistically.

II. Office Automation (OA)

Let us use a survey conducted in October, 1983 by the Ministry of Labor (Ministry of Labor, Policy Investigation Department, comp., "Facts on Technological Innovations and Labor, OA" November, 1984. Hereinafter referred to as "OA") to examine the state of technological innovations (office automation) in the office and non-manufacturing departments of companies. This survey was carried out of 6,000 privately owned businesses employing 100 or more permanent workers.

(1) 81.1% of the businesses had introduced OA equipment, and 8.2% of them were planning to introduce them for the first time within the next five years. The percentage of places of business which would have introduced them after five years would amount to 89.3%. (Fig.2.1, Table 2.5)

(2) Let us examine the state of introduction according to the size of the companies. All (100%) of the large businesses with 5,000 or more employees have introduced them. The corresponding percentages are 98.1% for those with 1,000 to 4,999 employees, 92.4% for those with 300 to 999 employees, and 76.1% for those with 100 to 299 employees.

(3) More than 30% of the companies had introduced the following six types of OA equipment: facsimile devices (58.4%), office computers (48.3%), personal computers (36.8%), word processors (34.8%), on-line terminals (32.3%), and general-purpose computers (31.1%). Other types of OA

equipment were: microfilm systems (5.2%), computer-assisted design (CAD) systems (2.9%) and voice input/output devices (0.3%). (Fig.2.1, Table 2.5)

Table 25 plots the percentages of the companies planning to introduce various types of OA equipment for the first time against the companies which have not yet introduced them. The percentages are 28.4% for word processors, 24.8% for office computers, 19.3% for personal computers, 15.6% for facsimile devices and 7.0% for general-purpose computers. Among the companies which have already introduced OA equipment, the following are the percentages of companies planning to expand various types of equipment: CAD (65.5%), personal computers (55.8%), on-line terminal devices (55.1%), word processors (44.8%), office computers (40.4%), general-purpose computers (39.5%), voice input/output devices (33.3%), microfilm systems (30.8%) and facsimile devices (25.3%).

(4) To obtain an idea of the times when various types of OA equipment were introduced, let us examine the shifting percentages of businesses introducing the different types of equipment. General-purpose computers had the highest percentage (15.8%) in 1975. This increased to 24.0% in 1980 and 30.7% in 1983. Thus, general-purpose computers have been introduced at a relatively leisurely rate of increase. On the other hand, facsimile devices and office computers were introduced in 1975 by only 4.4% and 7.4%, respectively,

of the businesses. However, their respective percentages increased rapidly to 25.5% and 27.1% in 1980, and to 57.2% and 47.6% in 1983. Other types of equipment which have been introduced at a phenomenal rate are personal computers and word processors. Personal computers had a percentage of only 1.1% in 1975, but this increased to 7.1% in 1980 and to 36% in 1983. Word processors had near-zero percentages of 0.2% in 1975 and 2.1% in 1980, but in 1983 this had increased rapidly to 34.1%. They were introduced at an explosive rate because their performance had improved and their prices had become inexpensive. The percentages of companies which plan to introduce various types of equipment for the first time within the next five years are falling off somewhat, but in almost all types of equipment, the percentages of companies planning to expand existing equipment exceed the percentages planning to introduce the same types of equipment for the first time. It is noteworthy that word processors and personal computers, in particular, still continue to increase with a steady curve. (Fig. 2.2)

Table 2.6 shows the degree to which office automation has progressed in companies which have already introduced OA equipment. The highest percentage (42.1%) is occupied by businesses which replied that they "have introduced and are using OA equipment singly for specific jobs." This is followed by businesses in which "systems of OA equipment and general-purpose computers are in operation" (29.7%).

Another 7.8% replied that "a company-wide system centering around general-purpose computers has been completed." If we add together these latter two groups, we find that "systemization" is being carried out in 37.5% of the companies.

When we examine the state of office automation in relation to the size of the companies, we find that systemization has made more progress in the larger companies, and that on the contrary in the smaller-size companies there is a higher percentage of those which "have introduced and are using OA equipment singly for specific jobs." (Table 2.6)

(5) As for the purposes for which OA equipment has been introduced, the largest percentage (87.5%) mentioned "rationalization and increasing efficiency of office work." Other replies were: "speeding up information-processing" (35.7%), "cutting processing costs of office work" (19.2%), "holding down increases in number of personnel" (17.3%), "improving services to clients" (11.2%), "reducing number of personnel" (7.0%) and "reinforcing planning and forecasting work" (6.3%). (Fig. 2.3) Here also, introduction of OA equipment was justified exclusively in terms of management efficiency and costs, and only 1.0% mentioned "improvement of working conditions." As for the successful achievement of these purposes for which the equipment was introduced, the largest numbers replied that they had successfully achieved "holding down numbers of personnel" (54.5%) and "speeding up information-processing" (53.9%). Other replies indicated success-

ful achievement of "improving services to clients" (49.1%), "rationalization and increasing efficiency of office work" (45.5%) and "cutting processing costs of office work" (32.8%). Those companies planning to expand their equipment in the future reported the following purposes in high percentages: "rationalization and increasing efficiency of office work" (40.3%), "speeding up information-processing" (29.0%) and "reinforcing planning and forecasting work" (22.5%). If we compare these purposes with the purposes mentioned at the initial introduction, we notice that higher percentages of the companies replied that they were planning to expand their equipment for the purpose of "reinforcing planning and forecasting work" (22.5%) and for the purpose of "improving services to clients" (14.6%).

Table 2.1. Percentages of places of business which have introduced and are manufacturing devices utilizing integrated circuits, percentages of companies which are manufacturing integrated circuits, and times when they plan to introduce such devices in the future

(Unit: %)

①区分	②計	③有	④無		
			⑤計	⑥今後の導入予定(M.A.)	
				⑦年以内	⑧2～3年以内
9「機器」の導入	100.0	59.3	40.7	2.6	6.6
10「機器」の生産	100.0	13.1	86.9	…	…
11集積回路の生産	100.0	1.3	98.7	…	…

Key:

1. Classification
2. Total
3. Yes
4. No
5. Total
6. Planning to introduce in the future (M.A.)
7. Within one year
8. Within 2-3 years
9. "Devices" introduced
10. Manufacturing "devices"
11. Manufacturing integrated circuits

(Note)

1. "M.A." indicates multiple answers. The same abbreviation is also used in the tables to follow.
2. "..." indicates that this item was not surveyed. The same applies also in the tables to follow.

Table 2.2. Percentages of places of business which have introduced devices utilizing integrated circuits, classified by industries and sizes of places of business, and percentages of places of business planning to introduce them in the future

(Unit: %)

①産業・事業所規模	②導入事業所割合	③今後の導入予定(M.A.)	
		④1年以内に予定	⑤2〜3年以内に予定
⑥調査産業計	59.3	2.6	6.6
⑦1,000人以上	95.6	0.5	1.6
⑧300〜999人	77.1	1.9	3.8
⑨100〜299人	51.2	2.9	7.8
⑩食料品・たばこ	43.6	3.8	6.2
⑪繊維	38.8	2.5	9.5
⑫衣服	47.8	3.0	5.2
⑬木材・木製品	36.5	2.4	8.4
⑭家具・装備品	58.9	5.1	10.6
⑮ルプ・紙・紙加工品	52.1	3.9	5.7
⑯出版・印刷	69.2	2.1	4.8
⑰化学、石油・石炭	61.6	1.6	7.2
⑱ゴム・皮革	43.2	1.5	10.0
⑲窯業・土石	48.6	3.0	11.2
⑳鉄鋼	59.9	1.4	5.3
㉑非鉄金属	60.6	2.4	7.7
㉒金属製品	61.0	2.7	6.7
㉓一般機械	74.2	2.0	5.4
㉔電気機器	71.5	2.6	5.0
㉕輸送用機器	72.6	2.4	6.3
㉖精密機器	68.4	0.9	7.1
㉗武器・その他	51.1	3.0	5.0

[Key on next page]

Key to Table 2:

1. Industry, size of place of business
2. Percentage of places of business which have introduced devices
3. Plans to introduce them in the future (M.A.)
4. Plans to introduce within one year
5. Plans to introduce within 2-3 years
6. Total of all industries surveyed
7. 1,000 or more employees
8. 300 - 999 employees
9. 100 - 299 employees
10. Foodstuffs, tobacco
11. Textiles
12. Apparel
13. Lumber, wood products
14. Furniture and accessories
15. Pulp, paper, paper products
16. Publishing, printing
17. Chemicals, petroleum, coal
18. Rubber, leather
19. Ceramics, earth and rocks
20. Iron and steel
21. Non-ferrous metals
22. Metal products
23. General machinery
24. Electrical machinery
25. Transport machinery
26. Precision machinery
27. Weapons, etc.

(Notes)

1) The percentages of places of business which have introduced the devices and the percentages of places of business which plan to introduce them in the future are both percentages of the total number of places of business.
2) The places of business which have not yet introduced the devices at the present time were questioned about their plans to introduce them in the future.

Table 2.3. Places of Business (which have introduced the devices utilizing integrated circuits) classified according to their sizes and the time when they began to introduce the devices

(Unit: %)

①事業所規模	② 計	③1964年以前	1965～1969	1970～1974	1975～1979	④1980年以降
⑤計	100.0	0.6	5.9	24.5	40.6	28.3
⑥1,000人 以 上	100.0	2.5	22.0	41.7	28.8	4.6
⑦300～999人	100.0	0.5	7.7	31.6	40.2	20.0
⑧100～299人	100.0	0.4	2.9	18.9	42.4	35.3

Key:

1. Size of place of business
2. Total
3. 1964 or before
4. 1980 or later
5. Total
6. 1,000 or more employees
7. 300-999 employees
8. 100-299 employees

(Note) When totals do not add up to 100, it is because unclear elements are included in the totals. The same applies also to the following tables.

Table 2.4. Places of Business (which have introduced the devices) classified by their sizes and by the reasons for introduction

(M.A., mainly two or less) (Unit: %)

① 事業所規模	② 計	③ 価格が安くなり、購入可能となったため	④ 関連企業から導入を要請されたため	⑤ 人手不足への対処のため	⑥ 省力化のため	⑦ 製品の品質・精度の向上のため	⑧ 製品のコストダウンのため	⑨ 作業環境改善のため	⑩ その他
⑪ 計	100.0	9.8	3.1	4.6	63.2	62.5	33.2	4.1	3.9
1,000人以上	100.0	14.4	0.7	2.5	64.5	67.8	36.0	5.6	2.6
3 300～999人	100.0	11.9	1.8	3.8	68.3	62.1	31.9	5.3	3.3
4 100～299人	100.0	8.2	4.1	5.3	60.6	62.0	33.4	3.4	4.3

Key:

1. Size of place of business
2. Total
3. The prices became affordable
4. Asked by affiliated companies to introduce them
5. To deal with shortage of labor
6. To save labor
7. To improve the quality and precision of products
8. To reduce costs of products
9. To improve the workplace environment
10. Other reasons
11. Total
12. 1,000 or more employees
13. 300-999 employees
14. 100-299 employees

Table 2.5. Percentages of companies which have introduced OA equipment, etc., which plan to introduce equipment and to expand their existing equipment

(Unit: %)

① 企業規模 機種	② 企業計	③ A機器等を導入している企業 (A)	④今後5年間の導入・拡充予定企業			⑧年後の導入予定企業 (A+B)	⑨ 導入企業に対する新規導入予定企業の割合 (B/100−A)	⑩導入企業に対する拡充予定企業の割合 (C/A)
			⑤ 計 (B+C)	新規導入 ⑥ (B)	拡充 ⑦ (C)			
⑪ 計	100.0	81.1	70.2	8.2	62.0	89.3	43.2	76.4
⑫ 5,000 人以上	100.0	100.0	96.2	−	96.2	100.0	−	96.2
⑬ 1,000 − 4,999人	100.0	98.1	95.1	0.8	94.4	98.9	41.0	96.2
⑭ 300 − 999人	100.0	92.4	82.3	3.7	78.6	96.1	49.2	85.1
⑮ 100 − 299人	100.0	76.1	64.4	10.2	54.2	86.3	42.7	71.2
⑯用コンピュータ	100.0	31.1	17.1	4.8	12.3	35.9	7.0	39.5
⑰オフィスコンピュータ	100.0	48.3	32.3	12.8	19.5	61.1	24.8	40.4
⑱ーソナルコンピュータ	100.0	36.4	32.6	12.3	20.3	48.7	19.3	55.8
⑲ンライン端末装置	100.0	32.3	27.1	9.3	17.8	41.6	13.7	55.1
⑳ードプロセッサ	100.0	34.8	34.1	18.5	15.6	53.3	28.4	44.8
㉑ァクシミリ	100.0	58.4	20.5	6.5	14.8	64.9	15.6	25.3
㉒イクロフィルムシステム	100.0	5.2	4.3	2.7	1.6	7.9	2.8	30.8
㉓音声入出力装置	100.0	0.3	2.7	2.6	0.1	2.9	2.5	33.3
㉔ンピュータ援用設計システム（CAD）	100.0	2.9	6.5	4.5	1.9	7.4	4.6	65.5

Key:

1. Company size, type of equipment
2. Total of companies
3. Companies which have introduced OA equipment, etc. (A)
4. Companies planning to introduce or expand equipment within the next five years
5. Total (B + C)
6. Newly introduced (B)
7. Expanded (C)
8. Companies planning to introduce the equipment within five years (A + B)
9. Percentage of companies planning to introduce new equipment (percentage of companies which have not yet introduced equipment) (B/100-A)

[Key continued on next page]

Key to Table 5 (cont.):

10. Percentage of companies planning to expand (percentage of companies which have already introduced equipment) (C/A)
11. Total
12. 5,000 or more employees
13. 1,000 - 4,999 employees
14. 300 - 999 employees
15. 100 - 299 employees
16. General-purpose computers
17. Office computers
18. Personal computers
19. On-line terminals
20. Word processors
21. Facsimile devices
22. Microfilm systems
23. Voice input/output devices
24. Computer-assisted design (CAD) systems

(Note) The totals and the values for the company sizes are the percentages of companies which have introduced some type of OA equipment.

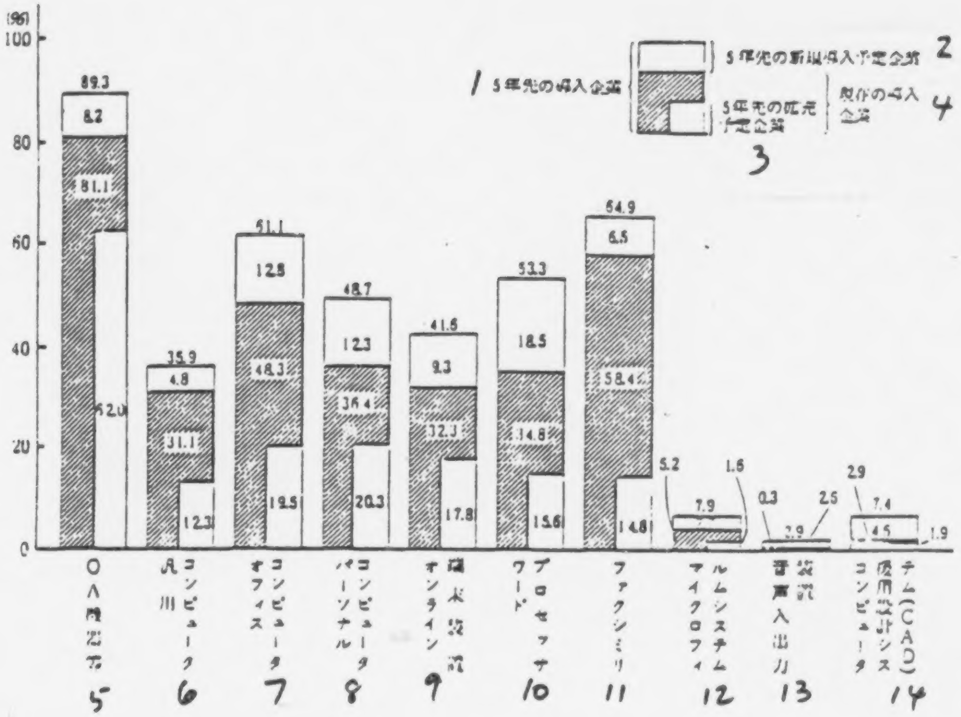


Fig. 2.1. Types of OA equipment introduced, percentages of places of business planning to introduce new equipment or planning t expand existing equipment

Key:

1. Companies which will introduce equipment in five years
2. Companies planning to introduce new equipment in five years
3. Companies planning to expand equipment in five years
4. Companies which have introduced it at the present time
5. OA equipment, etc.
6. General-purpose computers
7. Office computers
8. Personal computers
9. On-line terminals
10. Word processors
11. Facsimile devices
12. Microfilm systems
13. Voice input/output devices
14. Computer-assisted design (CAD) systems

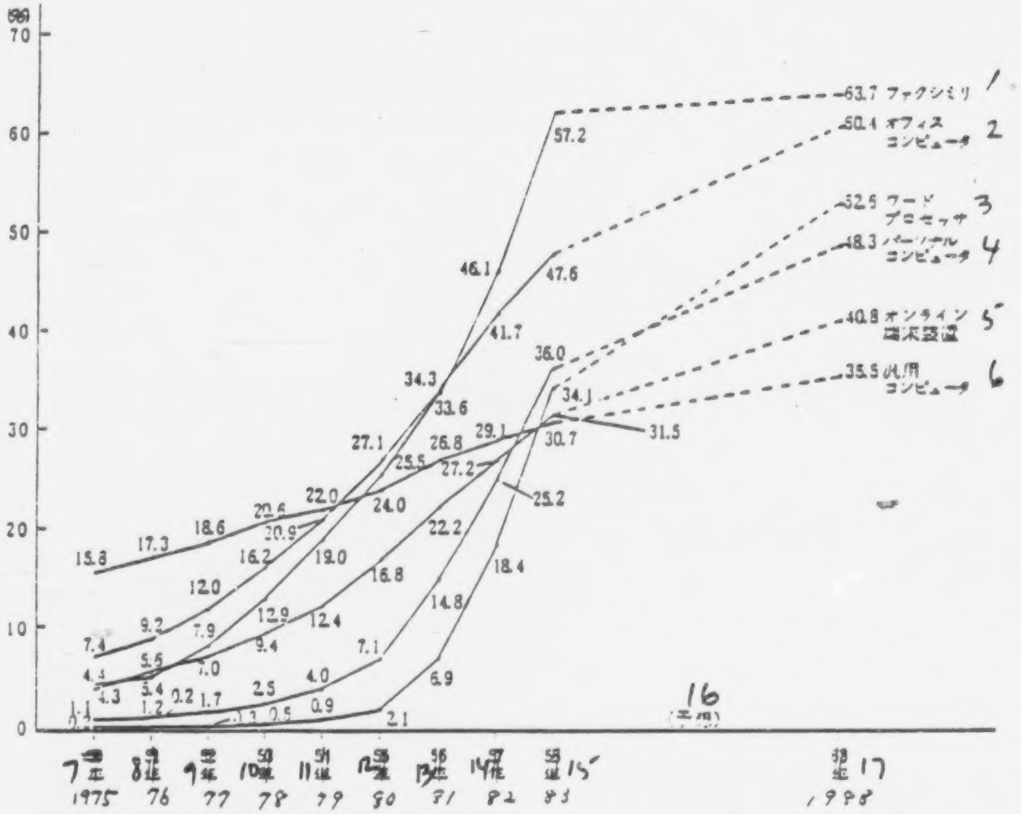


Fig.2.2. Shifts in percentages of companies introducing various types of equipment

Key:

1. Facsimile devices
2. Office computers
3. Word processors
4. Personal computers
5. On-line terminals
6. General-purpose computers
7. 1975
8. 1976

[Key continued on next page]

Key to Fig. 2 (cont.):

9. 1977
10. 1978
11. 1979
12. 1980
13. 1981
14. 1982
15. 1983
16. (predicted)
17. 1988

(Notes)

1) The percentages of companies which have introduced equipment were calculated in the following manner. The numbers of companies which had introduced different types of OA equipment, etc. as of the end of October, 1983 were cumulated from the year when they began to introduce the equipment, and the numbers were divided by the total number of companies.
2) Companies were excluded if the year when they began to introduce the equipment was unknown.
3) The percentages of companies which will introduce equipment by 1988 are based on plans as of the end of October 1983 to introduce equipment within five years.

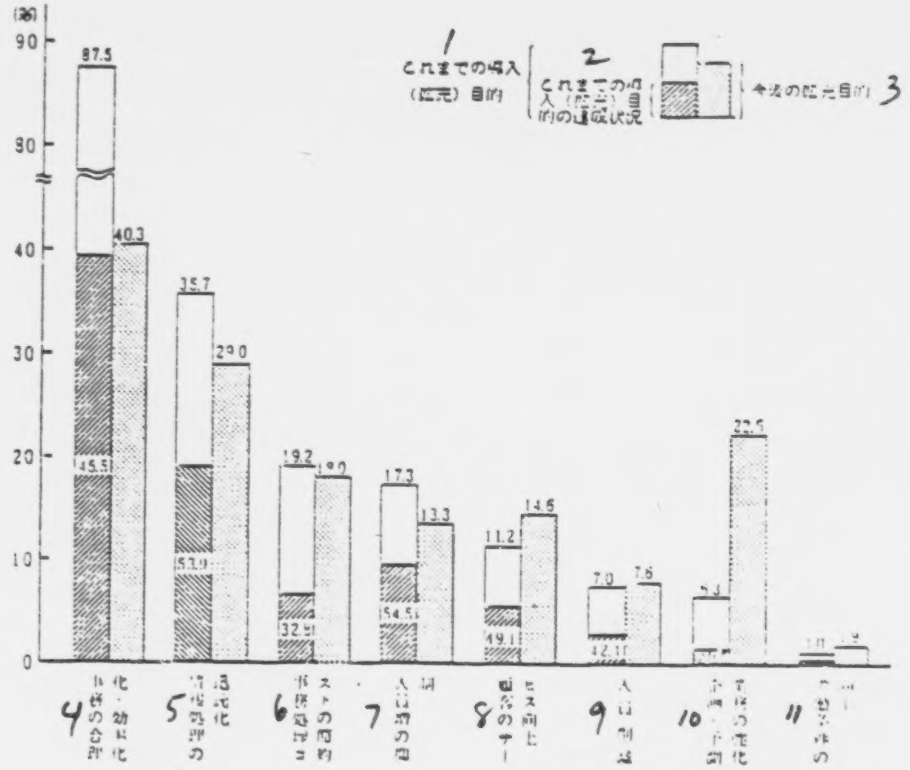


Fig.2.3. Percentages of companies classified according to purposes for which OA equipment, etc. was introduced (or expanded) and according to the state of achievement of their purposes

Key:

1. Purposes of introduction (or expansion) thus far
2. State of achievement of purposes of introduction (or expansion) thus far
3. Purposes of future expansion
4. Rationalization and increasing efficiency of office work
5. Speeding up information-processing
6. Cutting processing costs of office work
7. Holding down increases in number of personnel
8. Improving services to clients
9. Reducing number of personnel
10. Reinforcing planning and forecasting work
11. Improving working conditions

(Notes)

1. "Purposes of introduction (or expansion) thus far" are the percentages of companies classified by each purpose, using the number of companies which have introduced the OA equipment, etc. as 100.
2. "Purposes of future expansion" are the percentages of companies classified by the purposes for which they plan to introduce OA equipment, etc. in the future. The companies which have already introduced OA equipment, etc. and which plan to expand it in the future are taken as 100.
3. "State of achievement of purposes of introduction (or expansion) thus far" is the percentage of the companies which have achieved their purposes from among the companies which have introduced equipment thus far classified by their purposes.

Table 2.6. Percentages of companies classified by their current stage of introduction of OA (Unit: %)

1 企業規模	2 OA機器等を導入している企業	3 OA化の現在の段階				
		OA機器を試行的に入れ問題点を検討している 4	単独業務にOA機器を単体で導入・活用している 5	OA機器と汎用コンピュータとのシステム化を検討している 6	OA機器と汎用コンピュータのシステムが稼動している 7	汎用コンピュータを中心とする全社的システムが完成している 8
9 計	100.0	8.6	42.1	11.8	29.7	7.8
10 5.000 人以上	100.0	1.2	6.5	6.5	56.6	29.2
11 1.000 ～ 4.999 人	100.0	3.6	14.5	12.9	53.4	15.5
12 300 ～ 999 人	100.0	5.5	30.0	15.1	39.8	9.7
13 100 ～ 299 人	100.0	10.3	49.9	10.7	23.1	5.9

Key:

1. Company size
2. Companies which have introduced OA equipment, etc.
3. Current stage of introduction of OA
4. Have introduced OA equipment on a trial basis and are studying the problems
5. Have introduced and are using OA equipment singly for specific jobs
6. Are studying systematization of OA equipment and general-purpose computers
7. Systems of OA equipment and general-purpose computers are in operation
8. A company-wide system centering around general-purpose computers has been completed
9. Total
10. 5,000 or more employees
11. 1,000 - 4,999 employees
12. 300 - 999 employees
13. 100 - 299 employees

Chapter 3. Influence of Microelectronics on Employment

I. Changes in Numbers of Workers in the Workplace

(1) First let us see how the numbers of workers have changed during the process of introduction of microelectronics equipment. Using the Ministry of Labor Survey, "ME," let us compare the numbers of workers before and after the introduction of microelectronics equipment.

Since labor-saving was one of the purposes for which microelectronics equipment was introduced, it was naturally to be expected that the number of workers would decrease. As is shown in Table 3.1 38.5% of the places of business studied in this survey answered that "the number of personnel assigned decreased," while only 4% of them replied that the number had "increased." However, only 1.3% replied that the processes had been converted to "unattended operations." The majority (55.5%) replied that "there has been almost no change."

Differences can be seen in the changes in the number of workers depending on the state of introduction of microelectronics equipment into the processes. That is, in cases where the equipment had been "introduced into most" of the processes, there were larger changes, both in the increasing and in the decreasing directions, than in cases where it had been "introduced into some" of the processes. In the cases where the equipment had been introduced into most of the processes, "the number of personnel assigned decreased" in

48.0% of the processes and "increased" in 10.0% of them. It is noteworthy that, even in cases where the equipment had been introduced into only some of the processes, "the number of personnel assigned decreased" in 37.4% of the processes.

(2) Concrete examples of labor-saving in the workplace as a result of introduction of microelectronics equipment have been given in various survey reports. Here let us study the circumstances on the basis of the intermediate report of a questionnaire survey on labor-saving measures carried out by the Employment and Vocational Research Institute [1]. The survey, based on questionnaires sent to 772 companies in 17 lines of business, studies the effects on employment of the introduction of the first stage of microelectronics up to the end of the 1970s.

For example, cases such as the following are reported. In one case in the food industry, when continuous automatic equipment was introduced into a process for drying frozen foods, the number of employees was reduced from 53 to 23. In one case in the apparel industry, when the cutting process was automated, the number of employees was reduced from 4 to 1, and in another case when ten electronic sewing machines were introduced, the number of employees was reduced from 30 to 8. In one case in the chemical industry, when forming rolls and other processes in a manufacturing department were automated, the number of employees was reduced from 152 to 66, and in another case when three

---

(1) Quoted from Study Group on Computers and Female Workers, comp., "The ME revolution and female workers" (1983), pp. 111-2.

ramping machines were introduced the number of employees was reduced from 60 to 20. In one case in the metal industry, when a large-size reducing machine was introduced, the number of personnel was reduced to 30%. In one case in the electrical machinery industry, when robots were introduced into a process for pressing electrical machine parts, two-thirds of the personnel were eliminated, and in another case when a process for manufacturing printed circuit boards for tape recorders was automated, the number of personnel was reduced by about 60%. In one case in the automobile industry, when 50 robots were introduced into an assembly department, the number of employees was reduced from 300 to 150, and in another case when automatic pressing was introduced into a pressing department, the number of employees was reduced by half. In one case in the precision machinery industry, when a department for assembling camera lenses was automated, the number of personnel was reduced to one-fourth, and in another case when a shop manufacturing precision panels was converted to automation, the number of personnel was reduced to one-third while the output was increased tenfold.

Similar cases have also been reported in the tertiary industries. For example, in one case in the wholesale industry when the issuing of slips was automated with on-line displays, the number of personnel was reduced by 20%. In another case, when an information-management system was introduced into all the company's places of business, the number of personnel was reduced from 70 to 30. In one case in the retail industry when computers were introduced into an office department, the number of personnel was reduced from 18 to 9. Among the examples reported in the finance and insurance industries, in one case labor-saving equivalent to approximately 200 employees was achieved by the introduction of automatic cash machines and automatic change-making machines, and in another case the number of personnel was reduced by about 50 by the automation of window operations.

The concrete facts about labor-saving are company secrets, and many parts are not revealed to third parties. However, even the above results of the questionnaire survey reveal the tremendous rate with which labor-saving is proceeding. However, the examples obtained in this survey are dated from about five years ago. If we consider the advances made in microelectronics technologies and the speed with which they have been introduced, one may assume that labor-saving measures are being carried forward drastically at the present time.

II. Changes in Size of Places of Business and in Numbers of Workers in Companies as a Whole

(1) Let us give an overview of the changes of the numbers of workers in plants as a whole, excluding the office departments, on the basis of the aforesaid Ministry of Labor Survey, "ME." Comparing the time one year before the introduction of microelectronics equipment and the time of the survey (November, 1982), 4.6% of the places of business replied that the number of workers had "increased," while 30.1% of them replied that the number had "decreased." As for the size of the companies, it is clear that a smaller percentage of places of business belonging to larger companies replied that the number of workers had "increased," while a larger percentage of them replied that the number had "decreased" (Table 3.2)

As for the rate of decrease of the number of workers in the places of business in which the number of workers "decreased," in 37.2% of the places of business the rate of decrease was 9% or less, while in 27.7% of them it was 10-19%. If we combine both of these categories, we see that the rate of decrease was 20% or less in two-thirds of the places of business. As for the size of the companies, it is noteworthy that there is a larger percentage of places of business with a high rate of decrease among the small businesses. On the contrary, among the places of business in which the number of workers "increased," 22.2% of them had rates of increase of 9% or less, and 31.2% of them had rates of increase of 10-19%. If we combine both of these categories, we find that a majority of the places of business had rates of increase of 20% or less.

If we view the increases and decreases of the numbers of workers in connection with the increases and decreases of the production figures (Table 3.3), in 10.7% of the places of business in which the production "increased greatly" the number of workers "increased," while in 37.5% of them the number of workers "decreased." In 2.6% of the places of business in which the production "did not increase or decrease very much" the number of workers "increased," while in 27.6% of them the number of workers "decreased." This indicates that, even though increased employment is impossible without increased production, in places of business which have introduced microelectronics equipment, further reductions of personnel can proceed even when production increases greatly. Moreover, in cases where there is little increase or decrease of production, the number of employees can be reduced thanks to the influence of the introduction of microelectronics equipment.

The influence of introduction of microelectronics on employment will become even clearer if we compare the increases and decreases of employment in places of business which have introduced microelectronics equipment with those in places of business which have not introduced it. A survey made by the Vocational Training Research Center views the increases of production and employment from 1976 to 1981 with reference to whether or not automated equipment is introduced. In places of business which had introduced it, production increased by 56.0% (nominal figures) while employment decreased by 2.9%. In places of business which were studying introduction of the equipment, production increased by 43.0% while employment decreased by 3.7%. In places of business which were not considering introduction of the equipment, production increased by 21.0% while employment decreased by 14.2%. Sweeping conclusions cannot be made because there are differences between different types of industry. Nevertheless, the results establish clearly that the rate of decrease of employment for the place of business as a whole is less in places of business which have introduced automated equipment. A report of the Employment Security Office concerning the increase or decrease of employment shows that employment "increased" in 41.9%, "decreased" in 27.6%, and "remained unchanged" in 29.1% of the places of business which had introduced microelectronics, while it "increased" in 29.3%, "decreased" in 28.3%, and "remained unchanged" in 42.4% of the places of business which had not introduced microelectronics. As for the reasons for the increases or decreases in employment (multiple answers), the reason given in the overwhelming majority of cases for increases of employment (82.6%) was increase of production (or sales). The next most frequent reason (31.3%) was expansion of fields of business. The most frequent reason given for decreases of employment was reduction of production (or sales) (33.7%). Other reasons given were changes in manufacturing processes or methods (31.6%), restructuring of the company organization (29.5%), introduction of equipment applying microelectronics (17.9%), introduction of automated equipment other than microelectronics (11.6%), and various other reasons (20.0%). Here also it can be seen clearly that increased employment cannot occur unless it is accompanied by an expansion of production or of the fields of business, and that decrease of production (or sales) is a decisive factor leading to decrease of employment. At the same time, one can also see that technological innovations connected with the introduction of microelectronics equipment have a considerable impact on decreases of employment.

(2) Next let us study the changes in the numbers of workers resulting from the adoption of office automation on the basis of the aforesaid survey made by the Ministry of Labor ("OA").

The survey compared the number of workers in privately-owned companies with 100 or more employees as of the end of October, 1983, when the survey was made, with the number five years previously. It found that the number had "increased" in 43.2% of the companies, that it had "not changed very much" in 29.7% of them, and that it had "decreased" in 27.0% of them (Table 3.4).

The predominant reason (94.4%) for the increases in the companies in which the number of workers had "increased" was "expansion of scale of business." Among the companies in which the number of workers had "decreased," large percentages of them gave as the reasons for the decreases "efficiencies of the business and non-manufacturing departments attributable to reasons other than the introduction of microelectronics and office-automation equipment" (45.0%) and "reduction of scale of business" (35.8%). It can be seen here also, basically, that the effects of fluctuations in business conditions such as expansion of production or reduction of scale of business are decisive factors in increases or decreases of the number of workers. Among the companies in which the number of workers had decreased, as many as 10.0% of them have as a reason "introduction of OA equipment, etc." It is noteworthy that, if the workers are limited to office workers alone, the percentage increases to as much as 27.0%.

As for the sex of the workers, the number of male workers increased in 42.6% of the companies, and the number of female workers increased in 35.7% of them. The number of male workers decreased in 24.6% of the companies, and the number of female workers decreased in 28.4% of them. The number of companies in which the numbers of both male and female workers increased was larger than the number in which the numbers decreased. However, a comparison between males and females shows that there was a smaller percentage of companies in which the number of female workers increased, while there was a higher percentage of companies in which their number decreased. Numerically speaking, one can see that the burden of labor-saving is being shifted onto females. Among the reasons for the decreased numbers, "introduction of OA equipment, etc." was given in 6.5% of the cases for males and in 17.1% of the cases for females. This higher percentage for females gives us grounds for making some suppositions about the influence of office automation on females.

Both in terms of company size and type of industry, the number of companies in which the number of workers had "increased" was greater than the number of companies in which the number had "decreased." However, there were particularly high percentages of companies in which the number of workers had increased among certain types of industries, such as the service industries (55.6%), the finance and insurance industries (54.4%), the real-estate industry (48.2%), and the wholesale and retail industries (43.0%). It was also apparent that, among the companies in the finance and insurance industries which had decreased numbers of workers, the "introduction of OA equipment" was mentioned as the reason for the decrease by highest percentage

(45.5%). These findings show that the influence of office automation is pronounced among female workers, among office workers and in the finance and insurance industries, but that, on the whole, workers are being absorbed chiefly in the tertiary industries.

Other surveys also reveal clearly how large an influence office automation has been exerting on the employment of female workers. For example, the Ministry of Labor made a survey of the state of office automation in the main headquarters of large companies. The survey report ("Fact-finding Survey of the Labor Force by Profession: Facts on Office Automation and Employment in Main Headquarters of Large Companies," 1982) points out that the numbers of female workers have decreased in all industries except the construction industry. That is, in the manufacturing industries there was a 6.4% increase of male workers and a 4.8% decrease of female workers; in the wholesale and retail industries there was a 2.7% decrease of male workers and an 8.8% decrease of female workers; in the finance, insurance and real estate industries there was a 4.7% increase of male workers and a 4.6% decrease of female workers; and in other industries there was a 0.1% increase of male workers and a 10.7% decrease of female workers. As for the types of professions, in 2.6% of the companies there were increases in the management and research office workers but decreases in the general office workers. In information-processing related jobs, 42.1% of the companies mentioned decreases in the number of key-punchers. If we recall that most of the general office workers and key-punchers are females, we realize that the influence of the introduction of microelectronics on female workers cannot be taken lightly.

III. Adjustment of Surplus Personnel Accompanying Labor-Saving Measures

From the survey materials cited thus far we have seen that quite drastic labor-saving effects result during the process of introduction of microelectronics, but that from the standpoint of the place of business or of the company as a whole, a larger percentage of companies state that the numbers of their workers have increased in comparison with before the introduction of the microelectronics equipment. At the same time, we have seen that the decisive factors in increasing the number of workers are, rather, increases of production and expansion of the scope of business; that even in companies in which the numbers of workers have increased, the introduction of microelectronics operates as a factor holding down increases of the number of workers; and that altogether as many as 27% of the companies surveyed reply that the numbers of their workers have decreased. Consequently, in every company, surplus labor power has occurred during the process of introduction of microelectronics equipment as a result of the resulting labor-saving, and it is necessary to take measures to adjust employment in some way or another. Here let us examine what the companies have done to deal with the surplus personnel. First, let us consult the Ministry of Labor Survey, "ME," to find out whether some measures or other have been implemented to adjust employment accompanying the introduction of microelectronics equipment. 29.5% of the places of business which have introduced the equipment replied that they had taken these measures (Table 3.5) As for the contents of these measures, only very few (0.4%) of them said that they fired workers or encouraged voluntary retirement. The overwhelming majority of them (28.0%) said that they transferred workers within the same places of business. In smaller numbers of cases, they said that they transferred workers to other places of business within the same company (3.3%) or that they sent them out on loan to affiliated companies (1.2%).

As for the sizes of the companies, the percentages of places of business which took measures to adjust employment were higher in larger companies. That is, 44.8% of those in companies with 1,000 or more employees, 33.0% of those in companies with 300-999 employees, and 25.8% of those in companies with 299 or fewer employees said that they had taken such measures. As for the contents of the measures taken, none of the large companies with 1,000 or more employees fired any workers or encouraged voluntary retirement, but these measures were taken in 0.2% of the companies with

300-999 employees and in 0.6% of those with 100-299 employees. Thus, the numbers tend to increase proportionally as the size of the companies decreases. This proves statistically that the custom of "lifetime employment" has taken firm root in the large companies, but it also indicates that there are some places of business belonging to medium and small-size companies, even though they amount to less than one percent, which have no capacity to transfer surplus workers even if they wish to. The percentages of places of business which transfer surplus workers or loan them to other affiliated companies, contrary to the percentages of places of business which fire them or encourage voluntary retirements, are proportionally higher in larger companies (Table 3.5)

Among the places of business which transferred surplus workers within the same place of business, in the overwhelming majority of cases (97.7%) they were transferred within the manufacturing department, but in fewer cases (10.6%) they were transferred to office or sales departments (multiple answers). However, as for the size, it is noteworthy that the percentage of places of business which transferred the surplus workers to office or sales departments increases in larger companies and that there was also a high percentage of transfers to office and sales departments in cases where workers were transferred to other places of business in the same company.

IV. Changes in Hiring

Let us consult the Ministry of Labor Survey, "ME," to survey the influence of introduction of microelectronics on hiring. The percentage of processes in which "there were considerable changes in hiring" amounted to 13.0% of the processes in which microelectronics equipment had been introduced and to 1.2% in processes in which it had not been introduced. Thus, it is clear that changes in hiring have been concentrated exclusively in the processes in which microelectronics has been introduced. (Table 3.6) Moreover, changes in hiring occurred in 28.0% of the processes in which microelectronics equipment had been "introduced for the most part" and in 11.1% of the processes in which it had been "introduced in some parts." Thus, changes in hiring are proportionally larger in processes where there is a higher rate of introduction of microelectronics equipment.

Let us examine the increases or decreases in the number of workers hired in the processes in which "there were considerable changes in hiring." The number hired decreased in more cases than it increased: i.e., the number hired increased in 37.2% of the processes, while it decreased in 47.2% of them. Let us examine the increases or decreases in terms of the types of workers hired. Hiring of university graduates majoring in physical sciences increased in more processes (increased 36.0%, decreased 7.4%), and the same applied to male high-school graduates (increased 37.5%, decreased 32.6%). However, hiring of university graduates majoring in subjects other than physical sciences decreased in more processes (increased 4.7%, decreased 14.2%), and the same applied to female high-school graduates (increased 17.2%, decreased 25.1%) and to part-time workers (increased 18.5%, decreased 21.9%). Changes in the skills needed in consequence of the introduction of microelectronics equipment appear in hiring practices in the form of increased hirings of university graduates majoring in physical sciences and of high-school graduates. This tendency is proportionally stronger in places of business where there is a higher rate of introduction of microelectronics equipment. (Table 3.6)

Next, as is shown in Table 3.7, from the viewpoint of the places of business or of the companies as a whole, one can see almost the same circumstances as were seen in the changes in hiring in specific processes in the places of business where the equipment has been introduced. That is, let us examine the changes in the numbers hired in places of business where "there were considerable changes in hiring" (11.2%). The numbers hired "increased" in 40.2% of these places of business, and the numbers "decreased" in 45.3% of them. Noteworthy is the breakdown by size of places of business. Among the smaller-sized places of business there was a higher percentage which said that the numbers hired "increased," while on the contrary a higher percentage of the larger places of business said that the numbers hired "decreased." Probably one could interpret this as meaning that the labor-saving effect due to introduction of microelectronics equipment appears most conspicuously in larger companies in the form of restraints on hiring. The trends toward increased or decreased hirings classified by types of workers are similar to the changes in the numbers hired in specific processes which we have already seen. That is, there was a tendency toward increased hiring of university graduates majoring in the physical sciences and of male high-school graduates, while there was a tendency toward decreased hiring of university graduates majoring in subjects other than the physical sciences and of female high-school graduates. However, the percentage of places of business which hired "increased" numbers of part-time workers exceeded slightly the number which hired "decreased" numbers of them. As for female high-school graduates, there was a proportionally higher percentage of decreased hiring and a proportionally lower percentage of increased hiring by companies of increasingly larger sizes. However, it is noteworthy that in places of business with 299 or fewer employees the percentage where hiring of them "increased" exceeded the percentage where it "decreased." When the places of business as a whole are examined, there is a clear-cut tendency for increased hiring of university graduates majoring in the physical sciences and of male high-school graduates because of the requirements for skills needed in connection with the introduction of microelectronics and for upgrading of skills. There is also an equally clear tendency for decreased hiring of other workers than these. If we bear in mind the decreased hiring of female high-school graduates and the fact that most female university graduates major in humanities, it is clear that the effects of the incorporation of microelectronics in hiring appear in their most concentrated form among females. However, when we examine the places of business as a whole, we find a tendency for the number of part-time workers hired to increase slightly; it is clear that part-time workers are being hired to replace female workers. In large companies, however, there is seen a tendency for even hiring of part-time workers to decrease. (Table 3.7)

Let us consult the survey made by the Ministry of Labor ("OA") to examine the changes in the hiring of workers in consequence of the introduction of office automation equipment. As is shown in Table 3.8, about 90% of the companies replied that there were "no changes" in their hiring of new workers both upon graduation and at other times around the year. However, if we examine in detail the increases and decreases, we find that there was a high rate of increase of male university graduates, and this tendency was especially strong in medium-sized companies. We also find that, although most companies said that there was a "decrease" in their hiring of female high-school graduates, a slight majority of the companies said that there was an "increase" in their hiring of graduates of junior colleges, technical colleges and universities. If we examine the hiring of females in terms of the size of the companies, we find that in all cases the rate of decrease is proportionally higher in larger companies. This also shows clearly that, with the exception of some highly educated specialists, females are being driven out of employment, with the large companies leading the way.

V. Changes in Composition of Workforce

Consulting the Ministry of Labor Survey, "ME," let us see how the composition of the workforce changed as a result of the changes in assignment and hiring in consequence of the introduction of microelectronics equipment.

Although, naturally, there were almost no changes (1.3%) in the processes into which the equipment was not introduced, there were "considerable changes" in 15.9% of the processes into which it was introduced. The breakdown shows that there were considerable changes in 33.6% of the processes into which the equipment was "introduced for the most part," and in 13.7% of the processes into which it was "introduced in part." Thus, the findings indicated that the composition of the workforce changes proportionally as introduction of microelectronics equipment proceeds. (Table 3.9)

Let us examine the nature of the changes in the processes in which the composition of the workforce was said to have "changed considerably." The percentage of males increased (increased 44.3%, decreased 31.2%), the percentage of younger workers increased (younger workers increased 50.3%, older workers increased 24.3%), the number of skilled workers decreased (increased 13.9%, decreased 60.2%), the number of simple and unskilled workers increased (increased 46.1%, decreased 23.3%), and the number of specialists increased (increased 58.6%, decreased 13.8%).

Let us examine these changes in the composition of the workforce in connection with the changes in skill. As is shown in Table 3.10, changes in the composition of the workforce appeared most conspicuously (36.5%) in processes where "previous skills were no longer needed and new skills were needed." The increases in the percentage of males and the increases in the number of specialists were highest in the processes where "skills on a higher level were needed." On the other hand, decreases in the number of skilled workers and the increases in the number of simple and unskilled workers appeared most often in processes where "skills on a lower level were sufficient." It is noteworthy that the decreases in the number of skilled workers, rather than being attributable to the fact that skills on a higher level were needed" were due rather to a pincer attack from two directions: previous skills were no longer needed, and at the same time skills on a lower level were sufficient.

These same tendencies toward a rise in the percentage of males, toward an increase in the percentage of younger workers in the age composition, toward a decrease in the number of skilled workers, toward an increase in the number of simple and unskilled workers and toward an increase in the number of specialists also appeared in about the same percentages when the data were viewed in terms of the places of business and the plants as a whole. In terms of the size of the companies, the rates of increase of the percentages of males and of the numbers of specialists tended to increase proportionally as the sizes of the companies increased. The percentages of large companies with 1,000 or more employees in which the numbers of simple and unskilled workers "increased" were about the same as the percentages in which they "decreased," but it is noteworthy that their numbers tended to increase proportionally as the sizes of the companies became smaller.

VI. Effects on Working Conditions

(1) Using the Ministry of Labor Survey, "ME," let us examine the changes in wages before and after the introduction of microelectronics equipment. In an overwhelming majority of places of business (95.7%) "the past wages were guaranteed" to workers who, after the introduction of the microelectronics equipment, continued to be assigned to the

processes into which the equipment was introduced. In a few places of business (4.2%), "wages were revised to wages corresponding to the new duties," but in the majority of places of business (88.9%), "wages increased" as compared with the past wages. Thus, it is clear that the revisions were advantageous to the workers.

As for workers who were transferred, as a result of the introduction of microelectronics equipment, from processes into which the equipment had been introduced to other processes or other departments within the same place of business, "the past wages were guaranteed" in most of the places of business (93.6%). However, in the places of business where the "wages were revised to wages corresponding to the new duties," large percentages of the places of business said either that wages of a majority of the employees decreased in comparison with the assigned workers or that the number of employees whose wages increased was "about the same" as the number of those whose wages decreased. A smaller percentage of places of business said that the wages of a majority of the employees increased. (Table 3.12)

(2) Changes in working hours in the processes into which microelectronics equipment was introduced differed depending on the state of introduction, but in more processes the hours "became shorter" than those in which they "became longer." The working hours became progressively shorter as introduction proceeded. (Table 3.13)

However, in terms of the place of business or the plant as a whole, in most cases (89%) the working hours were said to be "almost unchanged." Working hours "became shorter" in only 8.9% of the places of business. (Table 3.14)

(3) The introduction of microelectronics equipment has been exerting a certain influence on the working regimen in the processes into which it has been introduced. As is shown in Table 3.15,the working regimen "changed" in 21.5 % of the processes into which microelectronics equipment has been "introduced for the most part," and in 10.1% of the processes into which the equipment has been "introduced in part." As for the contents of the changes, it is noteworthy that "the shift system was adopted for the first time" in about 70% of the processes.

(4) In 65.9% of the places of business, the contents of work "changed" as a result of the introduction of microelectronics equipment. As for the contents of the changes, nearly half of the changes were changes made necessary in consequence of the introduction of the microelectronics equipment. That is, some places of business stated that "there was increased work monitoring the equipment" (51.9%), or that "there was increased work of routine maintenance of the equipment" (43.0%). There are also noteworthy figures indicating the advantageous aspects of introduction of the microelectronics equipment. That is, some places of business stated that "there was less heavy manual labor" (36.8%)

or that "there was less dangerous and harmful work" (30.5%). It is also noteworthy that the number of places of business stating that "there was less simple, repetitive work" (35.5%) exceeded the number stating that "there was more simple, repetitive work" (18.2%). (Table 3.16)

(5) Let us use the survey made by the Ministry of Labor ("OA") to study the changes in working conditions following the introduction of office-automation equipment. 34.2% of the companies said that "there were changes." The changes appeared in forms such as "reduced overtime" (85.9%), "shortened weekly work hours" (15.3%), "increased weekly time off" (5.4%) and "increased annual days off other than weekly time off" (3.3%). It is also noteworthy that a few of the smaller companies mentioned, as the contents of the changes, "adoption of the flex time system" and "adoption of wages based on job evaluation." (Table 3.17)

VII. Safety and Hygiene

(1) According to the Ministry of Labor Survey, "ME," the percentage of places of business which stated that workers had been injured or accidents had occurred as a result of microelectronics equipment was 2.5%. About half of these injuries and accidents occurred "during ordinary operation" (49.4%) or "during repairs" (47.8%), but nearly 10% of them occurred "when the equipment was put into operation again after repairs." (Table 3.18)

Replying to the question whether they consider it necessary to incorporate special measures or considerations in safety and hygiene in the operation of microelectronics equipment, 35.0% of the places of business which had introduced microelectronics equipment stated that they "think it is necessary." The percentage of places of business which are conscious of this necessity increases as the sizes of the places of business increase (Table 3.19). Among the places of business which replied that they "think it is necessary," 78.0% have "incorporated special measures or considerations," 18.7% are "studying" the matter, and 3.2% have "done nothing in particular." As for the sizes of the companies, "special measures or considerations" are incorporated more in larger companies. On the other hand, the companies which, although feeling the necessity, have "done nothing" are more numerous than the smaller companies, although the percentage of such companies is quite small. As for the contents of the "special measures or considerations," the largest percentages are those replying that they are carrying out "education and training on a priority basis" (64.3%) or are incorporating "special considerations about maintenance" (63.2%). Others reply that they are incorporating "special considerations about layout, such as the places where the equipment is installed" (49.5%) or have "permanently assigned specialists" (21.3%). (Table 3.19)

(2) Next let us consult the survey made by the Ministry

of Labor ("OA") to examine the safety and hygiene measures taken by companies following the introduction of office-automation equipment.

46.7% of the companies which have introduced office-automation equipment replied that "it is necessary to take measures concerning labor hygiene." In companies with 5,000 or more employees the percentage rose to 78.9%, indicating that there is an increasing perception of the necessity of such measures as the size of companies increases. Of the companies which replied that "it is necessary to take measures," 41.9% stated that they are "implementing measures," 31.5% stated that they are "studying" the matter, and 26.6% stated that they "are not doing anything in particular." As for the size of the companies, just as we saw above in the case of microelectronics, the percentage of the companies which are "implementing measures" rises as the size of the companies increases, while, on the contrary, the percentage of the companies which "are not doing anything in particular" increases as the size of the companies decreases (Table 3.20). As is shown in Table 3.21, in most cases the contents of the measures are "improvements of the working environment." These measures include "lighting measures" (75.4%), "air-conditioning equipment" (60.3%) and "measures to deal with noise" (39.4%). This is followed by "special health check-ups for employees working with office-automation equipment" (17.8%) and "education on safety and hygiene" (11.4%).

(Table 3.21)

Video display terminals are the type of office-automation equipment which present the largest problems from the standpoint of safety and hygiene. There are operators of display terminals in 66.4% of the companies which have introduced office-automation equipment. Only 16.2% of these companies have established maximum limits for the monthly working hours, and only about two-thirds of these latter companies have limits of 6 hours or less (Table 3.22). 19.3% of the companies have rules on each continuous period of work for display-terminal operators. The period is less than 1-2 hours in 7.8%, less than 1 hour in 6.6%, and less than 2-3 hours in 3.5% of them. (Table 3.23) 15.3% of the companies have rules about the rest time after each continuous period of work. The rest time is "15-20 minutes" in 5.3%, "less than 15 minutes" in 5.4%, "30 minutes or longer" in 2.2%, and "20-30 minutes" in 1.8% of them. (Table 3.24)

In 74.5% of the companies, operators of display devices had lodged complaints or pointed out problems. As for the contents, the largest amount were related to the "place of installation of devices for preventing light reflection on the screen" (56.6%). This was followed by "flickering of characters or graphics on the screen, size of characters, etc." (37.7%), "arrangement of keyboard, ease of pressing keys" (20.2%), "position and height of keyboard" (19.8%), and "inclination and height of screen, distance between screen and eyes" (15.7%). (Table 3.25)

Table 3.1. Processes classified by stage of introduction of microelectronics equipment and increases or decreases of personnel assigned to processes (processes in places of business into which microelectronics equipment has been introduced) (unit: %)

1 導入状況	2 計	3 配置人員が増加した	4 配置人員が減少した	5 無人化した	6 ほとんど変わらない
7 導入工程	100.0	4.5	38.5	1.3	55.5
8 大部分に導入	100.0	10.0	18.0	2.2	39.1
9 一部に導入	100.0	3.9	37.4	1.2	57.5
10 非導入工程	100.0	2.3	2.6	0.1	91.9

Key:

1. State of introduction
2. Total
3. Number of assigned personnel has increased
4. Number of assigned personnel has decreased
5. Has become unattended
6. Almost no change
7. Processes into which microelectronics equipment has been introduced
8. Introduced into most parts
9. Introduced into a part
10. Processes into which microelectronics equipment has not been introduced

Table 3.2. Places of business (into which microelectronics equipment has been introduced) classified by sizes of places of business by rates of increase or decrease of number of workers in plant as a whole
-- The places of business in which the numbers of workers had "increased" or "decreased" were taken as 100, respectively -- (Unit: %)

1 事業所規模	2 増加した						4 減少した					
	3 計	～9%	10～19%	20～29%	30～49%	50～99%	100%～	3 計	～9%	10～19%	20～29%	30～49%	50%～
5 計	(4.6) 100.0	22.2	31.2	13.8	12.9	6.3	11.7	(30.1) 100.0	37.2	27.7	16.5	11.3	6.2
6 1,000人以上	(3.5) 100.0	9.5	33.3	19.0	4.8	14.3	14.3	(40.3) 100.0	40.2	30.3	12.7	11.5	2.0
7 300～999人	(4.1) 100.0	27.1	23.5	15.3	17.6	3.5	12.9	(34.3) 100.0	39.6	29.2	15.0	9.5	5.4
8 100～299人	(5.1) 100.0	21.6	33.9	12.8	11.9	6.6	11.0	(26.8) 100.0	35.1	26.3	18.1	12.3	7.6

Key:

1. Sizes of places of business
2. Increased
3. Total
4. Decreased
5. Total
6. 1,000 or more employees
7. 300-999 employees
8. 100-299 employees

(Note) The numbers enclosed in parentheses in the "Increased" and "Decreased" columns are the percentages of places of business in which the numbers of workers "increased" or "decreased," respectively, with respect to the total places of business into which microelectronics equipment had been introduced.

Table 3.3. Places of business (into which microelectronics equipment has been introduced) classified by increases or decreases of production and by rates of increase or decrease of number of workers in plant as a whole
-- The places of business in which the numbers of workers had "increased" or "decreased" were taken as 100, respectively -- (Unit: %)

1 生産額の増減	2 増加した							4 減少した					
	3 計	~9%	10~19%	20~29%	30~49%	50~99%	100%~	3 計	~9%	10~19%	20~29%	30~49%	50%~
5 計	(4.6)100.0	22.2	31.2	13.8	12.9	6.3	11.7	(30.1)100.0	37.2	27.7	16.5	11.3	6.2
⑥ 幅に増加した	(10.7)100.0	15.3	33.2	14.7	14.7	7.4	12.1	(37.5)100.0	25.4	30.3	16.2	16.2	10.2
⑦ まり増減はなかった	(2.6)100.0	31.5	28.7	12.6	10.5	4.9	11.2	(27.6)100.0	42.6	26.7	16.4	8.9	4.4
⑧ 幅に減少した	(-)	-	-	-	-	-	-	(45.0)100.0	-	-	44.4	44.4	11.1

Key:
1. Increases or decreases of production
2. Increased
3. Total
4. Decreased
5. Total
6. Increased greatly
7. Little increases or decreases
8. Decreased greatly

(Note) See (Note) of Table 3.2).

Table 3.4

1 第十表　5年前と比較した労働者数の変化状況別企業の割合

2（単位：%）

3 性 企業規模 産業 職種	4 企業計	5 増加した	6 増加の理由（M.A.）					12 あまり変わらない	13 減少した	14 減少の理由（M.A.）						該当労働者がいない 21	差（増加した－減少した） 22
			事業規模 7 の拡大	ME機器 8 の導入	OA機器 9 等の導入	内製化 10 の促進	その他 11			事業規模 15 の縮小	ME機器 16 の導入	OA機器 17 等の導入	左記2つ以外の現業・間接部門の効率 18 化	業務又は事務の外部委託 19	その他 20		
23 計	100.0	43.2(100.0)	(94.4)	(0.9)	(3.2)	(10.9)	(10.9)	29.7	27.0(100.0)	(35.8)	(3.8)	(10.0)	(45.0)	(12.5)	(35.8)	－	ポイント 16.2 46
24 男子	100.0	42.6(100.0)	(92.9)	(1.5)	(2.4)	(10.2)	(12.2)	32.7	24.6(100.0)	(35.5)	(3.6)	(6.5)	(44.8)	(13.4)	(35.7)	－	18.0
25 女子	100.0	35.7(100.0)	(88.7)	(0.7)	(5.8)	(10.0)	(14.6)	35.9	29.4(100.0)	(28.3)	(3.4)	(17.1)	(46.5)	(10.6)	(33.7)	－	7.3
26 5,000人以上	100.0	43.0(100.0)	(95.8)	(0.7)	(0.7)	(1.7)	(9.1)	30.7	26.3(100.0)	(17.6)	(2.4)	(32.4)	(79.8)	(5.1)	(24.3)	－	16.7
27 1,000～4,999人	100.0	47.1(100.0)	(96.1)	(0.3)	(2.4)	(3.7)	(10.0)	27.8	25.1(100.0)	(26.8)	(8.1)	(16.9)	(60.9)	(16.0)	(29.1)	－	22.0
28 300～999人	100.0	48.2(100.0)	(94.6)	(0.7)	(2.3)	(6.9)	(11.1)	26.3	25.4(100.0)	(30.3)	(5.6)	(9.5)	(53.2)	(16.8)	(29.6)	－	22.8
29 100～299人	100.0	41.5(100.0)	(94.1)	(1.1)	(3.6)	(13.0)	(11.0)	30.8	27.7(100.0)	(38.2)	(3.0)	(9.3)	(41.1)	(11.2)	(38.2)	－	13.8
30 鉱業	100.0	22.6(100.0)	(91.5)	(－)	(－)	(－)	(8.4)	48.2	29.2(100.0)	(44.9)	(8.5)	(－)	(39.8)	(－)	(46.7)	－	－6.6
31 建設業	100.0	40.4(100.0)	(96.5)	(－)	(1.1)	(6.4)	(10.5)	38.8	20.8(100.0)	(46.3)	(0.4)	(5.4)	(30.4)	(15.6)	(40.8)	－	19.6
32 製造業	100.0	43.8(100.0)	(94.1)	(2.2)	(2.4)	(19.6)	(9.5)	26.6	29.6(100.0)	(37.4)	(7.8)	(7.4)	(40.3)	(12.7)	(38.0)	－	14.2
33 卸売業、小売業	100.0	43.0(100.0)	(96.3)	(－)	(6.6)	(4.2)	(11.4)	27.2	29.8(100.0)	(30.0)	(－)	(17.0)	(63.1)	(10.4)	(28.0)	－	13.2
34 金融・保険業	100.0	54.4(100.0)	(95.6)	(－)	(4.4)	(0.5)	(11.2)	28.3	17.3(100.0)	(14.5)	(－)	(45.5)	(68.2)	(7.7)	(26.9)	－	37.1
35 不動産業	100.0	48.2(100.0)	(97.6)	(－)	(－)	(－)	(9.1)	34.3	17.5(100.0)	(30.3)	(－)	(10.5)	(48.9)	(7.3)	(45.4)	－	30.7
36 運輸・通信業	100.0	29.6(100.0)	(87.2)	(－)	(1.2)	(5.0)	(15.5)	41.3	29.1(100.0)	(46.0)	(0.6)	(5.3)	(35.0)	(14.3)	(34.7)	－	0.5
37 電気・ガス・水道・熱供給業	100.0	34.5(100.0)	(79.2)	(－)	(－)	(－)	(30.8)	33.0	12.5(100.0)	(13.8)	(－)	(15.0)	(70.1)	(57.5)	(13.8)	－	22.0
38 サービス業	100.0	55.6(100.0)	(93.7)	(－)	(2.2)	(3.5)	(12.6)	48.0	16.4(100.0)	(24.0)	(－)	(6.4)	(32.0)	(14.5)	(50.4)	－	39.2
39 管理職	100.0	32.7(100.0)	(81.2)	(0.1)	(0.9)	(6.6)	(24.7)	65.2	10.4(100.0)	(46.4)	(0.5)	(2.7)	(43.6)	(5.4)	(32.8)	1.4	22.3
40 専門・技術・研究職	100.0	22.9(100.0)	(85.6)	(2.6)	(3.6)	(10.2)	(16.6)	28.7	5.1(100.0)	(38.9)	(1.3)	(5.4)	(39.1)	(10.3)	(38.3)	39.6	17.8
41 事務職	100.0	25.0(100.0)	(90.3)	(0.8)	(7.3)	(6.2)	(12.2)	48.6	24.8(100.0)	(21.2)	(0.5)	(27.0)	(63.1)	(8.5)	(20.5)	－	0.2
42 情報処理職	100.0	21.7(100.0)	(47.6)	(3.1)	(63.3)	(3.3)	(6.4)	39.6	4.2(100.0)	(24.7)	(1.3)	(25.4)	(38.4)	(21.0)	(28.2)	32.2	17.5
43 生産・技能職	100.0	24.9(100.0)	(91.6)	(2.1)	(0.5)	(16.5)	(10.1)	23.4	19.8(100.0)	(35.0)	(10.8)	(2.1)	(23.7)	(16.7)	(41.9)	29.1	5.1
44 営業・販売職	100.0	35.2(100.0)	(90.1)	(0.2)	(2.1)	(6.3)	(16.6)	33.5	10.2(100.0)	(42.7)	(0.1)	(4.0)	(34.4)	(6.7)	(38.4)	19.7	25.0
45 その他	100.0	7.8(100.0)	(86.9)	(0.1)	(0.5)	(4.9)	(20.2)	17.4	6.3(100.0)	(40.6)	(0.1)	(1.5)	(30.8)	(18.2)	(37.3)	61.9	1.5

47（注）48 1）増加の理由及び減少の理由は、それぞれ2項目以内の重複回答。
49 2）「計」、「増加した」及び「減少した」の各内訳には、「不明」があるか掲載を省略しているため内訳の合計は100.0にはならない。

[Key on next page]

Key to Table 3.4:

1. Table 3.4. Percentages of companies classified by changes in their numbers of workers as compared with five years previously
2. (Unit: %)
3. Sex
   Size of company
   Type of industry
   Job classification
4. Total companies
5. Increased
6. Reasons for increase (multiple answers)
7. Expanded scope of business
8. Introduction of microelectronics equipment
9. Introduction of office-automation equipment, etc.
10. Accelerated conversion to in-house production
11. Other reasons
12. Little change
13. Decreased
14. Reasons for decrease (multiple answers)
15. Decreased scope of business
16. Introduction of microelectronics equipment
17. Introduction of office-automation equipment, etc.
18. Increased efficiency of office and non-manufacturing departments attributable to reasons other than the two just given
19. External contracting of tasks of office work
20. Other reasons
21. No such workers
22. Difference (Increased - Decreased)
23. Total
24. Males
25. Females
26. 5,000 or more employees
27. 1,000 - 4,999 employees
28. 300-999 employees
29. 100-299 employees
30. Mining industry
31. Construction industry
32. Manufacturing industries
33. Wholesale and retail industries
34. Finance and insurance industries
35. Real-estate industry
36. Transport and communication industries
37. Industries supplying electricity, gas, water and heat
38. Service industries
39. Managerial positions

[Key continued on next page]

Key to Table 4 (cont.):

40. Specialists, researchers
41. Office workers
42. Information-processing workers
43. Production and skilled workers
44. Management and sales workers
45. Others
46. Points
47. (Notes)
48. 1) The reasons for increase and for decrease are multiple answers (maximum 2 answers).
49. 2) In the breakdowns for "Total," "Increased" and "Decreased" there are some unclear items. Since these were omitted, the totals of the breakdowns will not add up to 100.0.

Table 3.5. Places of business (into which microelectronics equipment has been introduced) classified by size of places of business and by state of implementation of transfers, etc. (Unit: %)

1 事業所規模	2 計	3 行った (M.A.)							9 関係会社へ出向させた	10 解雇や希望退職募集を行った	11 ほとんど行わなかった
		2 計	4 同一事業所内で配置転換した			8 同一企業内の他事業所へ配置転換した					
			2 計	5 配転先の部門		2 計	5 配転先の部門				
				生産 6	事務・販売 7		生産 6	事務・販売 7			
12 計	100.0	29.5	28.0 (100.0)	(97.7)	(10.6)	3.3 (100.0)	(92.0)	(13.3)	1.2	0.4	70.4
13 1,000人以上	100.0	44.8	43.0 (100.0)	(98.8)	(14.6)	6.1 (100.0)	(97.3)	(51.1)	3.1	-	55.0
14 300～999人	100.0	33.0	32.0 (100.0)	(97.5)	(12.8)	3.6 (100.0)	(93.3)	(52.0)	1.7	0.2	67.0
15 100～299人	100.0	25.8	24.2 (100.0)	(97.5)	(8.2)	2.8 (100.0)	(89.7)	(35.7)	0.7	0.6	71.1

Key:

1. Size of places of business
2. Total
3. Carried out (multiple answers)
4. Transferred inside the same place of business
5. Departments to which transferred
6. Production
7. Office, sales
8. Transferred to other places of business inside the same company
9. Sent on loan to affiliated companies
10. Firings were carried out or voluntary resignations were encouraged
11. Almost nothing done
12. Total
13. 1,000 or more employees
14. 300-999 employees
15. 100-299 employees

Table 3.6. Processes classified by state of introduction of microelectronics equipment and by increases or decreases of number of hirings in the processes (processes in places of business into which microelectronics equipment has been introduced)
-- Processes in which there were "considerable changes" in hiring are taken as 100 -- (Unit: %)

1 導入状況	2 計	3 採用数		6 採用労働者の種類									
				7 大卒（理工系）		8 大卒（理工系以外）		9 高卒男子		10 高卒女子		11 パートタイマー	
		4 増加した	5 減少した	4 増加した	5 減少した	4 増加した	5 減少した	4 増加した	5 減少した	4 増加した	5 減少した	4 増加した	5 減少した
12 導入工程	(13.0)100.0	37.2	47.2	36.0	7.4	4.7	14.2	37.5	32.6	17.2	25.1	18.5	21.9
13 大部分に導入	(28.0)10[illegible]	44.9	41.1	44.9	6.1	5.0	14.7	43.8	28.7	22.8	25.6	17.7	20.8
14 一部に導入	(11.1)100.0	34.8	49.1	33.3	7.8	4.6	14.1	35.5	33.8	15.5	25.0	18.8	22.8
15 非導入工程	(1.2)100.0	56.3	24.3	23.6	3.5	9.7	4.2	44.4	16.7	26.4	6.9	20.8	9.0

Key:

1. State of introduction of microelectronics equipment
2. Total
3. Number of hirings
4. Increased
5. Decreased
6. Types of workers hired
7. University graduates (physical science majors)
8. University graduates (non-physical science majors)
9. Male high-school graduates
10. Female high-school graduates
11. Part-time workers
12. Processes into which microelectronics equipment has been introduced
13. Introduced in most parts
14. Introduced in a part
15. Processes into which microelectronics equipment has not been introduced

(Note) The numbers enclosed in parentheses are the percentages of processes in which "considerable changes" had occurred in hiring, with respect to the processes in places of business into which microelectronics equipment has been introduced.

Table 3.7. Places of business (into which microelectronics equipment has been introduced) classified by size of places of business and by increases and decreases of number of hirings in plant as a whole
-- The places of business in which there have been "considerable changes" in hiring were taken as 100 -- (Unit: %)

1 事業所規模	2 計	3 採用数		6 採用労働者の種類									
				7 大卒（理工系）		8 大卒（理工系以外）		9 高卒男子		10 高卒女子		11 パートタイマー	
		4 増加した	5 減少した	4 増加した	5 減少した	4 増加した	5 減少した	4 増加した	5 減少した	4 増加した	5 減少した	4 増加した	5 減少した
12 計	(11.2)100.0	40.2	45.3	42.6	6.2	8.7	14.5	39.5	29.4	21.1	23.9	22.2	20.0
13 1,000人以上	(15.9)100.0	31.3	59.4	44.8	9.4	8.3	19.8	22.9	53.1	12.5	10.6	12.5	21.9
14 300～999人	(11.4)100.0	34.5	52.5	47.9	10.5	8.4	22.3	36.1	35.7	23.1	30.7	23.9	21.8
15 100～299人	(10.5)100.0	45.0	38.9	39.5	3.4	8.9	9.6	44.6	21.1	21.9	17.0	23.1	18.7

Key:

1. Size of places of business
2. Total
3. Number of hirings
4. Increased
5. Decreased
6. Types of workers hired
7. University graduates (physical science majors)
8. University graduates (non-physical science majors)
9. Male high-school graduates
10. Female high-school graduates
11. Part-time workers
12. Total
13. 1,000 or more employees
14. 300-999 employees
15. 100-299 employees

(Note) The numbers enclosed in parentheses are the percentages of places of business in which "considerable changes" have occurred in hiring, with respect to the places of business into which microelectronics equipment has been introduced.

Table 3.8. Companies classified by changes in hiring of workers in consequence of introduction of office-automation equipment, etc.

1 (1) 新規大卒以上

2（単位：%）

	4 企業規模	5 OA機器等を導入している企業	6 変化の状況			
			増加した (A) 7	減少した (B) 8	変化なし 9	差 10 (A−B)
11 男子	計 13	100.0	10.0	2.2	87.9	ポイント 18 7.8
	5,000人以上 14	100.0	11.0	4.1	84.9	6.9
	1,000～4,999人 15	100.0	14.6	4.4	80.8	10.2
	300～999人 16	100.0	12.7	2.3	85.1	10.4
	100～299人 17	100.0	8.5	1.9	89.6	6.6
12 女子	計 13	100.0	2.7	1.6	95.7	1.1
	5,000人以上 14	100.0	9.1	7.9	83.0	1.2
	1,000～4,999人 15	100.0	7.1	3.5	89.5	3.6
	300～999人 16	100.0	4.4	1.9	93.8	2.5
	100～299人 17	100.0	1.5	1.2	97.3	0.3

（注）「変化なし」には、「あまり変わらない」及び「採用していない」を含む。以下同じ。 19

3 (2) 新規短大・高専卒

2（単位：%）

	4 企業規模	5 OA機器等を導入している企業	6 変化の状況			
			増加した (A) 7	減少した (B) 8	変化なし 9	差 10 (A−B)
11 男子	計 13	100.0	3.2	1.2	95.6	ポイント 18 2.0
	5,000人以上 14	100.0	5.2	3.6	91.1	1.6
	1,000～4,999人 15	100.0	5.0	2.5	92.5	2.5
	300～999人 16	100.0	4.8	1.2	94.1	3.6
	100～299人 17	100.0	2.4	1.0	96.7	1.4
12 女子	計 13	100.0	5.5	3.7	90.8	1.8
	5,000人以上 14	100.0	8.1	17.9	[illegible]	[illegible]
	1,000～4,999人 15	100.0	5.2	5.6	89.1	−0.4
	300～999人 16	100.0	7.6	3.5	88.9	4.1
	100～299人 17	100.0	4.5	3.0	92.5	1.5

20 (3) 新規高卒

2（単位：%）

	4 企業規模	5 OA機器等を導入している企業	6 変化の状況			
			増加した (A) 7	減少した (B) 8	変化なし 9	差 10 (A−B)
11 男子	計 13	100.0	5.5	4.1	90.4	ポイント 18 1.4
	5,000人以上 14	100.0	4.3	13.4	82.3	−9.1
	1,000～4,999人 15	100.0	4.9	11.3	83.8	−6.4
	300～999人 16	100.0	6.1	5.2	88.6	0.9
	100～299人 17	100.0	5.4	2.8	91.8	2.6
12 女子	計 13	100.0	7.3	8.9	83.8	−1.6
	5,000人以上 14	100.0	3.6	26.2	70.3	−22.6
	1,000～4,999人 15	100.0	4.7	20.9	74.5	−16.2
	300～999人 16	100.0	9.4	10.0	80.6	−0.6
	100～299人 17	100.0	6.9	6.9	86.1	0.0

21 (4) 中途採用者

2（単位：%）

4 企業規模	5 OA機器等を導入している企業	6 変化の状況			
		増加した (A) 7	減少した (B) 8	変化なし 9	差 10 (A−B)
計 13	100.0	7.4	5.4	87.2	ポイント 18 2.0
5,000人以上 14	100.0	5.0	6.3	88.7	−1.3
1,000～4,999人 15	100.0	5.5	7.6	84.9	−2.1
300～999人 16	100.0	8.2	6.1	85.7	2.1
100～299人 17	100.0	7.2	4.6	88.2	2.6

[Key on next page]

Key to Table 3.8:

1. (1) New graduates of universities or higher
2. (Unit: %)
3. (2) New graduates of junior colleges and technical colleges
4. Size of company
5. Companies into which microelectronics equipment has been introduced
6. State of changes
7. Increased (A)
8. Decreased (B)
9. No changes
10. Difference (A-B)
11. Males
12. Females
13. Total
14. 5,000 or more employees
15. 1,000 - 4,999 employees
16. 300-999 employees
17. 100-299 employees
18. Points
19. (Note) "No changes" includes "little changes" and "no hiring." The same applies below.
20. (3) New graduates of high schools
21. (4) Persons hired at other times around the year

Table 3.9. Processes (into which microelectronics equipment has been introduced) classified by state of introduction and by changes in composition of workforce in the processes -- The processes in which there have been "considerable changes" in hiring were taken as 100 -- (Unit: %)

1 導入状況	2 計	3 男子比率		6 年齢構成		9 熟練工		12 単純・未熟練工		13 技術者	
		4 上昇した	5 低下した	7 若年化した	8 高齢化した	10 増加した	11 減少した	10 増加した	11 減少した	10 増加した	11 減少した
導入工程 14	(15.9) 100.0	44.3	31.2	50.3	24.3	13.9	60.2	46.1	23.3	58.6	13.8
大部分に導入 15	(33.6) 100.0	55.6	26.0	52.3	23.0	17.9	56.3	49.4	21.4	71.3	8.8
一部に導入 16	(13.7) 100.0	40.9	32.8	49.8	24.6	12.6	61.6	45.1	23.9	54.7	15.4
非導入工程 17	(1.3) 100.0	39.6	28.6	48.7	20.1	18.2	33.8	43.5	24.0	34.4	18.2

Key:

1. State of introduction
2. Total
3. Percentage of males
4. Increased
5. Decreased
6. Age composition
7. Became younger
8. Became older
9. Skilled workers
10. Increased
11. Decreased
12. Simple, unskilled workers
13. Specialists
14. Processes in which microelectronics equipment was introduced
15. Introduced in most parts
16. Introduced in a part
17. Processes in which microelectronics equipment was not introduced

(Note) The numbers enclosed in parentheses are the percentages of processes in which "considerable changes" have occurred in the workforce composition, with respect to the processes of places of business into which microelectronics equipment has been introduced.

Table 3.10. Processes (into which microelectronics equipment has been introduced) classified by changes in skills and by changes in composition of the workforce in the processes -- The processes in which the composition of the workforce has "changed considerably" were taken as 100, respectively --

(Unit: %)

1 技能の変化	2 計	3 男子比率		6 年齢構成		9 熟練工		12 単純・未熟練工		13 技術者	
		上昇した 4	低下した 5	若年化した 7	高齢化した 8	増加した 10	減少した 11	増加した 10	減少した 11	増加した 10	減少した 11
14 計	(15.9) 100.0	44.3	31.2	50.3	24.3	13.9	60.2	46.1	23.3	58.6	13.8
15 従来の技能が不要になり、新しい技能が必要になった	(36.5) 100.0	44.8	30.1	54.8	20.0	13.4	67.5	49.0	24.0	59.0	13.2
16 従来の技能のほかに、新しい技能が必要となった	(19.1) 100.0	46.6	28.3	53.4	24.8	17.4	58.4	44.2	26.1	66.8	11.1
17 より高い水準の技能が必要となった	(27.3) 100.0	50.2	27.5	52.2	21.5	21.8	53.1	37.5	30.7	72.3	6.1
18 より低い水準の技能で十分となった	(24.1) 100.0	28.8	46.8	44.2	29.7	4.7	75.6	69.5	11.3	39.5	26.5
19 あまり変化していない	(3.5) 100.0	39.5	32.9	30.5	26.3	11.4	34.1	32.9	22.2	21.6	21.0

Key:

1. Changes in skills
2. Total
3. Percentage of males
4. Increased
5. Decreased
6. Age composition
7. Became younger
8. Became older
9. Skilled workers
10. Increased
11. Decreased
12. Simple, unskilled workers
13. Specialists
14. Total
15. Past skills became unnecessary and new skills became necessary
16. New skills became necessary in addition to past skills
17. Skills of a higher level became necessary
18. Skills of a lower level became sufficient
19. Little change

(Note) The numbers enclosed in parentheses are the percentages of processes in which "considerable changes" have occurred in the workforce composition, with respect to the processes into which microelectronics equipment has been introduced.

Table 3.11. Places of business (into which microelectronics equipment has been introduced) classified by size of place of business and by changes in composition of the workforce in the plant as a whole
-- The places of business in which the composition of the workforce has "changed considerably" were taken as 100, respectively -- (Unit: %)

1 事業所規模	2 計	3 男子比率		6 年齢構成		9 熟練工		12 単純・未熟練工		13 技術者	
		上昇した 4	低下した 5	若年化した 7	高齢化した 8	増加した 10	減少した 11	増加した 10	減少した 11	増加した 10	減少した 11
14 計	(12.2) 100.0	48.4	26.6	48.4	24.9	15.3	54.8	44.8	23.0	63.0	11.6
15 1,000人以上	(15.9) 100.0	57.3	20.8	28.1	37.5	17.7	55.2	33.3	34.4	77.1	6.3
16 300～999人	(12.7) 100.0	52.3	27.8	42.5	33.5	11.7	59.0	46.2	19.5	58.6	12.4
17 100～299人	(11.5) 100.0	44.8	27.0	55.2	18.1	16.8	52.5	46.1	22.6	62.5	12.2

Key:

1. Sizes of places of business
2. Total
3. Percentage of males
4. Increased
5. Decreased
6. Age composition
7. Became younger
8. Became older
9. Skilled workers
10. Increased
11. Decreased
12. Simple, unskilled workers
13. Specialists
14. Total
15. 1,000 or more employees
16. 300-999 employees
17. 100-299 employees

(Note) The numbers enclosed in parentheses are the percentages of places of business in which "considerable changes" have occurred in the plant as a whole, with respect to the places of business into which microelectronics equipment has been introduced.

Table 3.12. Places of business (into which microelectronics equipment has been introduced) classified by changes in wages of assigned workers, places of business classified by changes in wages of transferred workers (Unit: %)

1 区分	2 計	3 従来の賃金を保証している	4 新しい職務に対応した賃金に変えている			
			5 計	上がった者が多い 6	下がった者が多い 7	ほぼ同数 8
9 配置労働者の賃金	100.0	95.7	4.2 (100.0)	(88.9)	(1.0)	(7.2)
10 配転者の賃金	100.0	93.6	6.2 (100.0)	(10.5)	(15.9)	(41.3)

Key:

1. Classification
2. Total
3. Past wages are guaranteed
4. Wages are changed to wages corresponding to new jobs
5. Total
6. Wages increased in most cases
7. Wages decreased in most cases
8. Wages increased and decreased in about the same number
9. Wages of assigned workers
10. Wages of transferred workers

(Notes)

1) The wages of transferred workers are given in terms of percentages using the wages in the place of business within which the transfer took place as 100.
2) "Assigned workers" means workers who continued to be assigned in the same process after the equipment was introduced into it. "Transferred workers" means workers who were transferred, in consequence of the introduction of the equipment, from a process into which the equipment was introduced to another process of department within the place of business.

Table 3.13. Processes classified by the state of introduction of microelectronics equipment and by the changes in working hours in the processes (processes in places of business into which microelectronics equipment has been introduced)

(Unit: %)

1 導入状況	2 計	3 長くなった	4 短くなった	5 ほとんど変わらない
6 大部分に導入	100.0	5.2	21.5	72.9
7 一部に導入	100.0	3.2	12.9	83.9
8 導入していない	100.0	0.4	2.1	96.5

Key:

1. State of introduction
2. Total
3. Hours are longer
4. Hours are shorter
5. Almost no change
6. Introduced in most parts
7. Introduced in a part
8. Not introduced

Table 3.14. Places of business (into which microelectronics equipment has been introduced) classified by sizes of places of business and by changes in working hours in plant as a whole (Unit: %)

1 事業所規模	2 計	3 長くなった	4 短くなった	5 ほとんど変わらない
6 計	100.0	1.9	8.9	89.0
7 1,000人 以上	100.0	0.8	8.6	90.4
8 300～999人	100.0	1.8	8.0	89.8
9 100～299人	100.0	2.1	9.3	88.4

Key:

1. Size of place of business
2. Total
3. Hours are longer
4. Hours are shorter
5. Almost no change
6. Total
7. 1,000 or more employees
8. 300-999 employees
9. 100-299 employees

Table 3.15. Processes classified by state of introduction of microelectronics equipment and by changes in working regimen (Processes in places of business into which microelectronics equipment has been introduced) (Unit: %)

1 導入状況	2 計	3 変化した				8 勤務形態は変わらない
		4 計	5 新たに交替制を採用	6 交替制を廃止	7 その他勤務形態が変化	
9 大部分に導入	100.0	21.5 (100.0)	(69.8)	(4.8)	(25.4)	78.2
10 一部に導入	100.0	10.1 (100.0)	(72.4)	(3.7)	(23.9)	89.9
11 導入していない	100.0	0.8 (100.0)	(62.0)	(9.0)	(29.0)	98.3

Key:

1. State of introduction
2. Total
3. Regimen has changed
4. Total
5. Shift system adopted for the first time
6. Shift system discontinued
7. Other changes in working regimen
8. Working regimen has not changed
9. Introduced in most parts
10. Introduced in a part
11. Not introduced

Table 3.16. Places of business classified by changes in contents of work (places of business into which microelectronics equipment has been introduced)
-- Taking as 100 the places of business in which the contents of the work have "changed" -- (M.A.)

(Unit: %)

1 計	2 危険有害作業が少なくなった	3 重筋作業が少なくなった	4 機器の維持・保守作業が多くなった	5 機器の監視労働が増えた	6 単純繰返し労働が増えた	7 単純繰返し労働が減った	8 その他
(65.9) 100.0	30.5	36.8	43.0	51.9	18.2	35.5	4.3

Key:

1. Total
2. There is less dangerous and harmful work
3. There is less heavy manual work
4. There is more equipment maintenance work
5. There is more work monitoring equipment
6. There is more simple, repetitive work
7. There is less simple, repetitive work
8. Other

(Note)

The numbers enclosed in parentheses are the percentages of places of business in which the contents of the work have "changed" with respect to the places of business into which microelectronics equipment has been introduced.

Table 3.17. Companies classified by the changes in their working conditions in consequence of introduction of office-automation equipment, etc. (Unit: %)

1 企業規模	2 OA機器等を導入している企業	3 変化有	4 変化の内容 (M. A.)								変化無 13
			週所定労働時間の短縮 5	残業時間の減少 6	週休の 7 増加	週休以外の年間休日の増加 8	フレックスタイム制の採用 9	在宅勤務制度の採用 10	職能給の採用 11	その他 12	
14 計	100.0	34.2	(100.0)	(15.6)	(85.9)	(5.4)	(3.3)	(3.0)	(-)	(3.0)	(3.1)	65.8
15 5,000人以上	100.0	35.2	(100.0)	(11.6)	(94.9)	(6.9)	(5.7)	(-)	(-)	(-)	(2.0)	64.8
16 1,000 ～ 4,999人	100.0	40.1	(100.0)	(12.6)	(90.1)	(4.8)	(3.1)	(3.6)	(-)	(1.4)	(2.5)	59.9
17 300 ～ 999人	100.0	36.3	(100.0)	(14.9)	(88.1)	(5.5)	(3.8)	(2.4)	(-)	(3.0)	(1.2)	63.7
18 100 ～ 299人	100.0	32.8	(100.0)	(16.4)	(84.3)	(5.3)	(3.2)	(3.2)	(-)	(3.3)	(3.9)	67.2

Key:

1. Company size
2. Companies into which office-automation equipment, etc. has been introduced
3. There are changes
4. Contents of changes (multiple answers)
5. Shortened weekly work hours
6. Reduced overtime
7. Increased weekly time off
8. Increased annual days off other than weekly time off
9. Adoption of the flex time system
10. Adoption of work-at-home system
11. Adoption of wages based on job evaluation
12. Others
13. No changes
14. Total
15. 5,000 or more employees
16. 1,000 - 4,999 employees
17. 300-999 employees
18. 100-299 employees

Table 3.18. Places of business (into which microelectronics equipment has been introduced) classified by size of places of business and by occurrence of injuries and accidents caused by equipment utiliting integrated circuits

(Unit: %)

1 事業所規模	2 計	3 あった (M.A.)				8 特になかった
		4 計	通5常の稼働中	修6理中	修理後の7再稼働の際	
9 計	100.0	2.5 (100.0)	(49.4)	(47.8)	(9.4)	97.4
10 1,000人以上	100.0	3.3 (100.0)	(40.0)	(75.0)	(5.0)	96.5
11 300〜999人	100.0	3.1 (100.0)	(54.7)	(43.8)	(14.1)	96.8
12 100〜299人	1000	2.1 (100.0)	(47.9)	(44.8)	(7.3)	97.8

Key:

1. Size of places of business
2. Total
3. Have occurred (multiple answers)
4. Total
5. During normal operation
6. During repairs
7. When resuming operation after repairs
8. None in particular have occurred
9. Total
10. 1,000 or more employees
11. 300-999 employees
12. 100-299 employees

Table 3.19. Places of business (into which microelectronics equipment has been introduced) classified by size of places of business and by implementation of special measures or considerations in safety and hygiene
-- Taking as 100 the places of business which "think it is necessary" to incorporate special measures or considerations --

(Unit: %)

1 事業所規模	2 計	3 特別の対策・配慮をしている (M.A.)						10 対策・配慮の内容について検討中である	11 特に何もしていない
		4 計	5 専門家を常時配置している	6 教育訓練を重点的に行っている	7 レイアウトについて特別に配慮している	8 保守・点検について特別に配慮している	9 その他		
12 計	(35.0)	78.0(100.0)	(21.3)	(64.3)	(49.5)	(63.2)	(5.1)	18.7	3.2
13 1,000人以上	(55.7)	86.6(100.0)	(28.4)	(78.1)	(60.3)	(66.4)	(6.8)	11.9	1.5
14 300～999人	(40.8)	78.2(100.0)	(22.0)	(68.2)	(51.4)	(61.4)	(4.6)	19.2	2.5
15 100～299人	(29.5)	75.6(100.0)	(18.8)	(57.7)	(45.0)	(63.4)	(4.9)	20.2	4.2

Key:

1. Size of places of business
2. Total
3. Are implementing special measures or considerations (multiple answers)
4. Total
5. Specialists have been permanently assigned
6. Education and training is being carried out on a priority basis
7. Special considerations are incorporated about layout
8. Special considerations are incorporated about maintenance
9. Others
10. Contents of measures and considerations are being studied
11. Have done nothing in particular
12. Total
13. 1,000 or more employees
14. 300-999 employees
15. 100-299 employees

(Note)

The figures enclosed in brackets are the percentages of the places of business which replied that they "think it is necessary" to incorporate special measures or considerations in safety and hygiene, with respect to the places of business into which microelectronics equipment has been incorporated.

Table 3.20.Companies classified by implementation of measures concerning labor hygiene in consequence of introduction of office-automation equipment, etc. (Unit: %)

1 企業規模	2 ＯＡ機器等を導入している企業	3 労働衛生面の対策の必要性 有	4 特別の対策の実施			労働衛生面の対策の必要性 8 無
			対策を実施 5 している	対策を検討 6 している	特に何も 7 していない	
9 計	100.0	46.7（100.0）	（41.9）	（31.5）	（26.6）	53.3
10 5,000人以上	100.0	78.9（100.0）	（47.8）	（38.8）	（13.5）	21.1
11 1,000～4,999人	100.0	70.6（100.0）	（46.5）	（29.2）	（24.3）	29.4
12 300～999人	100.0	56.6（100.0）	（40.9）	（31.2）	（27.9）	43.4
13 100～299人	100.0	40.2（100.0）	（41.4）	（31.8）	（26.9）	59.8

Key:

1. Size of companies
2. Companies which have introduced office-automation equipment, etc.
3. It is necessary to implement measures concerning labor hygiene
4. Implementation of special measures
5. Measures are implemented
6. Measures are being studied
7. Nothing in particular is being done
8. It is not necessary to implement measures concerning labor hygiene
9. Total
10. 5,000 or more employees
11. 1,000 - 4,999 employees
12. 300-999 employees
13. 100-299 employees

Table 3.20. Table 3.21. Companies classified by contents of special measures implemented concerning labor hygiene in consequence of introduction of office-automation equipment, etc.

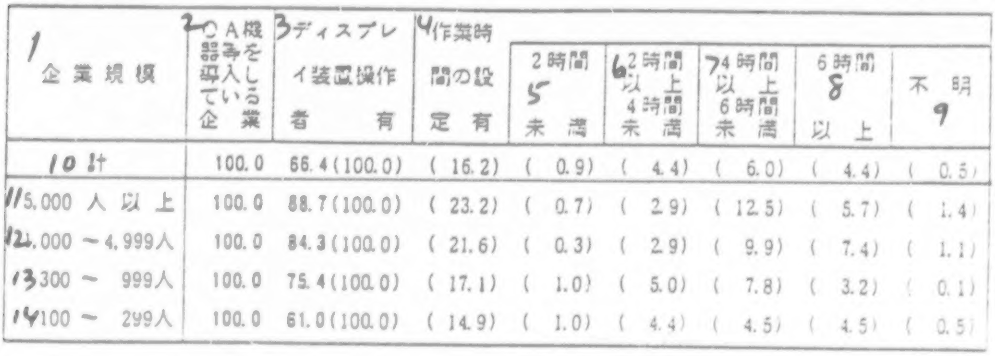
(Unit: %)

1 企業規模	2 特別の対策を実施している企業	3 対策の内容（M. A.）					
		4 作業環境の改善				9 OA機器等の導入に伴う安全衛生教育の実施	10 OA機器等の従事者に対する特別の健康診断の実施
		照明 5	騒音 6	空気調和設備 7	その他 8		
11 計	100.0	75.4	39.4	60.3	6.0	11.4	17.5
12 5,000 人以上	100.0	74.9	58.1	47.7	15.3	17.1	38.9
13 1,000～4,999人	100.0	72.8	51.0	59.8	10.2	10.3	38.3
14 300～ 999人	100.0	69.9	36.1	58.8	5.0	12.0	21.8
15 100～ 299人	100.0	78.7	37.8	61.7	5.2	11.1	10.7

Key:

1. Size of companies
2. Companies which have implemented special measures
3. Contents of measures (multiple answers)
4. Improvements of working environment
5. Lighting
6. Noise
7. Air-conditioning equipment
8. Others
9. Education in safety and hygiene following introduction of office-automation equipment, etc.
10. Special health check-ups for employees working with office-automation equipment, etc.
11. Total
12. 5,000 or more employees
13. 1,000 - 4,999 employees
14. 300-999 employees
15. 100-299 employees

Table 3.22. Companies classified by daily working hours of display-terminal operators (Unit: %)



1 企業規模	2 ＯＡ機器等を導入している企業	3 ディスプレイ装置操作者有	4 作業時間の設定有	2時間 5 未満	6 2時間以上4時間未満	7 4時間以上6時間未満	6時間 8 以上	不明 9
10 計	100.0	66.4(100.0)	(16.2)	(0.9)	(4.4)	(6.0)	(4.4)	(0.5)
11 5,000 人以上	100.0	88.7(100.0)	(23.2)	(0.7)	(2.9)	(12.5)	(5.7)	(1.4)
12,000 ～4,999人	100.0	84.3(100.0)	(21.6)	(0.3)	(2.9)	(9.9)	(7.4)	(1.1)
13 300 ～ 999人	100.0	75.4(100.0)	(17.1)	(1.0)	(5.0)	(7.8)	(3.2)	(0.1)
14 100 ～ 299人	100.0	61.0(100.0)	(14.9)	(1.0)	(4.4)	(4.5)	(4.5)	(0.5)

Key:

1. Size of companies
2. Companies which have introduced office-automation equipment, etc.
3. There are display terminal operators
4. There are rules on working hours
5. Two hours or less
6. 2-4 hours
7. 4-6 hours
8. 6 hours or more
9. Unclear
10. Total
11. 5,000 or more employees
12. 1,000 - 4,999 employees
13. 300-999 employees
14. 100-299 employees

Table 3.23. Companies classified by length of each continuous period of work of display-terminal operators (Unit: %)

1 企業規模	2 ディスプレイ装置操作者有	3 連続作業時間の設定有	1時間未満 4	1時間以上2時間未満 5	2時間以上3時間未満 6	3時間以上 7	不明 8
9 計	100.0	19.3	6.6	7.8	3.5	1.0	0.4
10 5.000 人以上	100.0	34.1	12.9	13.6	5.0	0.4	2.2
11 1.000 ~ 4.999人	100.0	28.2	10.4	13.1	3.6	0.4	0.7
12 300 ~ 999人	100.0	22.9	8.1	11.4	2.5	0.7	0.2
13 100 ~ 299人	100.0	16.3	5.3	5.4	3.8	1.3	0.5

Key:

1. Size of companies
2. There are display-terminal operators
3. There are rules on length of each continuous period of work
4. Less than 1 hour
5. 1-2 hours
6. 2-3 hours
7. 3 hours or longer
8. Unclear
9. Total
10. 5,000 or more employees
11. 1,000 - 4,999 employees
12. 300-999 employees
13. 100-299 employees

Table 3.24. Companies classified by rest time after each continuous period of work by display-terminal operators

(Unit: %)

1 企業規模	2 ディスプレイ装置操作者有企業	3 1連続作業後の休憩時間の設定有	4 15分未満	5 15分以上20分未満	6 20分以上30分未満	7 30分以上	8 不明
9 計	100.0	15.3	5.4	5.3	1.8	2.2	0.6
10 5,000 人以上	100.0	25.5	9.0	9.7	2.2	3.2	1.4
11 1,000 ～ 4,999 人	100.0	25.2	7.8	9.9	3.3	3.3	0.9
12 300 ～ 999 人	100.0	19.9	8.2	8.0	1.3	2.1	0.3
13 100 ～ 299 人	100.0	11.5	3.7	3.3	1.8	2.1	0.5

Key:

1. Size of companies
2. Companies which have display-terminal operators
3. There are rules about rest time after each continuous period of work
4. Less than 15 minutes
5. 15-20 minutes
6. 20-30 minutes
7. 30 minutes or longer
8. Unclear
9. Total
10. 5,000 or more employees
11. 1,000 - 4,999 employees
12. 300-999 employees
13. 100-299 employees

Table 3.25. Companies classified by problems pointed out by display-terminal operators, etc. (Unit: %)

1 企業規模	2 ディスプレイ装置操作者有企業	3 問題点の指摘有	4 指摘された問題点（M.A.）						11 問題点の指摘無
			5 キーボードの位置、高さ	6 キーの配列、打ちやすさ	7 スクリーンの傾斜度、高さ、目との距離	8 スクリーン上の文字や図形のちらつき及び文字の大きさ等	9 スクリーン上の光の反射防止のための設置場所	10 その他	
12 計	100.0	74.5 (100.0)	(19.8)	(20.2)	(15.7)	(37.7)	(56.6)	(12.1)	25.5
13 5,000 人 以 上	100.0	79.3 (100.0)	(29.3)	(31.7)	(21.0)	(52.5)	(68.0)	(6.3)	20.7
14 1,000～4,999人	100.0	79.8 (100.0)	(24.4)	(28.5)	(19.8)	(46.4)	(63.4)	(8.3)	20.2
15 300～ 999人	100.0	75.3 (100.0)	(23.4)	(17.3)	(15.8)	(39.5)	(57.2)	(9.6)	24.7
16 100～ 299人	100.0	73.3 (100.0)	(17.1)	(19.7)	(14.8)	(35.1)	(54.9)	(13.8)	26.7

Key:

1. Size of companies
2. Companies which have display-terminal operators
3. Problems have been pointed out
4. Problems which have been pointed out (multiple answers)
5. Position and height of keyboard
6. Arrangement of keyboard, ease of pressing keys
7. Inclination and height of screen, distance between screen and eyes
8. Flickering of characters or graphics on the screen, size of characters, etc.
9. Place of installation of devices for preventing light reflection on the screen
10. Others
11. No problems have been pointed out
12. Total
13. 5,000 or more employees
14. 1,000 - 4,999 employees
15. 300-999 employees
16. 100-299 employees

Chapter 4. Vocational Training

I. On-the-Job Education and Training

As described above, the introduction of microelectronics equipment into manufacturing processes brings about changes in the contents of previous work and in the required skills, degradations of certain skills of skilled workers, and polarization of jobs and duties. Therefore, in order to assign the workforce in a manner corresponding to the technological innovations of microelectronics, companies must take measures such as retraining of workers and formulating new employment plans.

The Ministry of Labor surveyed places of business which have introduced industrial equipment utilizing integrated circuits to discover what they were doing in the way of education and training of workers assigned to work connected with this equipment [1]. As is shown in Table 4.1, the results showed that 60.0% of the places of business said that they had provided education and training. As for the methods of education and training, the largest number of these places of business said that the education and training had been provided by the equipment manufacturer or the sales company. The next largest number replied that the education and training had been provided by the company itself. As for the sizes of the places of business, there was a tendency for education and training to be provided by the companies themselves in the larger places of business,

---

(1) Ministry of Labor, "Survey on Technological Innovations and Labor" (November, 1982).

while the weight of "in-company" education and training tended to drop in the smaller places of business. However, regardless of the size, 70% or more of the places of business made use of "education and training by the equipment manufacturer or sales company," and it is clear that there are no large differences in this respect. On the contrary, when the places of business which did not provide education and training were asked the reasons why they did not, the largest percentage of them, amounting to a majority, replied: "Because the necessary skills had already been taken care of by means of on-the-job training." This was followed by the answer: "Because it was not necessary." Small percentages of places of business gave the answers: "Because the skills necessary in the process had been secured by transferring personnel" or "Because the necessary skills had been secured by hiring new workers." Both these answers together made up less than 10%. As for the size of the places of business, the answer "Because the necessary skills had already been taken care of by means of on-the-job training" was given by a rather larger percentage of the larger-sized places of business. The percentage was more or less the same as the percentage of smaller places of business which gave the answer: "Because it was not necessary."

The "In-House Education Research Group," with the participation of the Ministry of Labor, carried out a "Survey of Technological Innovation, Aging of the Workforce, and

Effective Utilization of Personnel" (March , 1982). According to the report of the survey's results [2], personnel assigned to automated machine facilities in which automatic control equipment applying electronics was incorporated had the age composition shown in Fig. 4.1. That is, the largest number of them were in their thirties, and about 90% of them were males. As for their educational background, about 70% of them were high-school graduates. As for the levels of their skills, only 20% of the places of business mentioned "workers who do not have very high levels of skills or powers of understanding," such as inexperienced workers or female part-timers. Large numbers of "workers with high levels of skills" or "with powers of understanding" are assigned to such facilities, as is shown in Fig. 4.2. Automation has brought about a polarization of work into monotonous labor such as pushing buttons and monitoring equipment on the one hand, and intelligent skills such as setup work, adjustments, trouble-shooting, diagnosis and programming on the other. In cases where these two types of work are assigned to different personnel, simplification of operators' skills will advance on account of what may be called bipolarization of skills. However, since in actual fact both types of work are combined and performed by the same skilled workers, this indicates that the operators' skills are not tending to become simplified, but rather to become upgraded or more diversified. Next, as to where the

---

(2) Employment Promotion Projects Corporation, Vocational Training Center, comp., "Developing Manpower in the Mechatronics Age" (Ministry of Finance Printing Office, June, 1983)

personnel assigned to the automated equipment were transferred, 67% of the places of business answered that they were "personnel working with old facilities in the same department," as is shown in Fig. 4.3. As to the educational methods used to train the personnel, as is shown in Table 4.2. "in-company training" was used in most of the large-size companies, while "training by the manufacturers of the facilities" were used in most of the smaller companies. On the whole, however, it is obvious that education and training in the smaller companies is less vigorous than in the larger companies.

As a problem of retraining of workers, concern is being expressed about the adaptability of middle-aged and older workers to the operation of microelectronics equipment, and it is expected that a serious situation will occur in this respect as the Japanese working population ages rapidly in the future.

When we examine the tendencies towards increasing or decreasing hiring of various types of workers, as is shown in Table 4.3[3], in correspondence to the introduction of microelectronics equipment which results in the need for new skills and brings about an upgrading of the level of skills, the percentage of processes in which the hiring of university graduates majoring in physical sciences and male high-school graduates has "increased" has been surpassing the percentage of processes in which the hiring of such workers

---

(3) Same as (1).

has "decreased." The tendency towards increased hiring of these workers appears more pronounced in processes in which microelectronics equipment has been "introduced in most parts" than in processes in which it has been only "introduced in a part." In a larger percentage of processes there has been "decreased" hiring of workers who supposedly have less direct connection with manufacturing activities or who would probably be engaged in relatively simple work, such as university graduates majoring in subjects other than physical sciences, female high-school graduates or part-time workers. In this respect, the tendency seen here contrasts with the tendency in the processes in which microelectronics equipment has not been introduced.

As for personnel such as system engineers or programmers who are needed for introducing office automation into companies, Japanese companies are rapidly adopting on a broad basis the so-called "facility management" system, in which personnel is dispatched from another company, rather than training their own companies' employees for such work.

II. Public Vocational Training

The Ministry of Labor has thus far been providing computer and information-processing courses in its public vocational training facilities for training information-processing specialists. However, with the rapid progress of information-processing technologies, further increases of needs for vocational training are expected for training workers such as programmers and systems engineers to handle work connected with information processing and for improving their abilities. To deal with these anticipated needs, the Ministry has decided to add a new course in "Information Engineering" to its Long-Term Course for Training Instructors (training period 4 years) at its Vocational Training University. It will thus promote the training of instructors who will be in charge of giving training in information-processing technologies in public vocational training facilities and in companies [4].

The government has also established systems for promoting collaboration between public training and in-company training. One such system is a system of grants to promote "lifelong vocational training." In this system, employers are given grants in assistance for part of the expenses for carrying out in-company vocational training of workers who are required to change their jobs in consequence of the introduction of microelectronics equipment. The training is aimed at developing and improving vocational abilities, such as acquiring new vocations or specialized knowledge and skills. Another system is a system of grants encouraging employers of small businesses to send their employees to receive vocational training at accredited vocational training facilities.

One of the most popular governmental accreditation

---

(4) Ministry of Labor, "Dealing with Technological Innovations, Chiefly in Microelectronics" (August, 1984)

tests at the present time is the "test for information-processing specialists." It was started in fiscal year 1979 as a system for accrediting the level of software specialists. At the beginning the test was received by around 20,000 - 30,000 persons, but the number began to increase rapidly around 1981, and the number reached about 200,000 during fiscal year 1985. This reflects the "software crisis" (the shortage of software specialists). To respond to the need, the Ministry of International Trade and Industry has announced that it will give the tests, previously given once a year, twice a year beginning in fiscal year 1986.

III. Education in the Schools

The fact that the introduction of microelectronics has gone extremely smoothly in Japan in comparison with the countries of Europe and America is attributable, as mentioned below, to the workers' sense of belonging to the company which has been nurtured under the system of lifetime employment and also to the limits of the styles of activity of the company unions. On the other hand, one probably cannot deny that another major factor has been the fact that the workers had sufficient ability to deal with highly advanced new technologies. The background for this is the dissemination of education in the schools since the School Law (Gakusei) was passed in 1872. That is, education in

Japan was disseminated among the people under government guidance in order to build up the country as a backward capitalist country by absorbing modern Western civilization. By the beginning of the 20th century, the percentage of school attendance in elementary education had exceeded 90%. After the Second World War, the period of compulsory education was lengthened to nine years. During the period of high economic growth in the 1960s, the percentage of students going on to high schools and universities increased rapidly, as is shown in Table 4.4. It is this situation which has formed a labor market capable of adapting to technological innovations. Particular importance has been attached consistently, under the series of national policies followed through each period, to science education as a means of forming the person in accordance with national goals. That is, during the Meiji period (from the 1870s), the national policies were formulated as "wealth and military strength" and "increasing production to raise the nation's position"; during the Showa period (from the 1930s), the nation followed militaristic policies; and since the Second World War, a policy of high economic growth has been followed. Tables 4.5 and 4.6 give the class time devoted to teaching various subjects which are the basis of the curriculum in the courses of compulsory education at the present time. The existence in the lower grades of science courses which teach the rudiments of the natural science is a characteristic feature of Japan as compared with other capitalist countries. There is also a uniform policy throughout the country to provide ample science facilities in elementary schools, junior high schools and high schools in accordance with standards for facilities set forth in the Science Education Promotion Law.

The following suggestion has recently been made concerning consolidation of the basis for the "sound development of microelectronics": "Even though more advanced vocational education may be necessary for some microelectronics technologies in areas of actual applications, it is desirable to establish a system of information-processing education in the educational curriculum in the schools so that students at the elementary and junior high-school levels can acquire in a graduated fashion knowledge of basic programming and the operation of general microelectronics equipment" [5]. Computer-assisted instruction (CAI), in which microcomputers are utilized in teaching, is already being tried out in many schools [6]. The Educational Broadcasting Subcommittee of the Social Education Council, an advisory organ of the Minister of Education, made public in March, 1985 its report "On Utilization of Microcomputers in Education." This report contains a "Standard draft of a curriculum for training in educational use of microcomputers" for the purpose of raising the personal-computer skills of teachers. The Ministry of Education is said to be

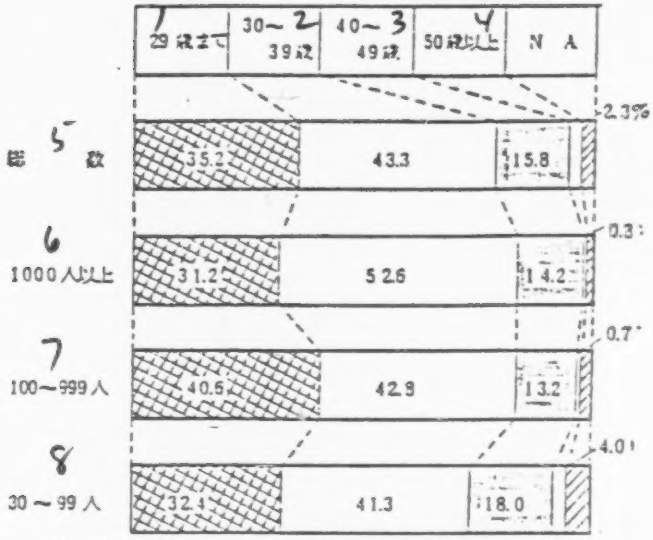
---

(5) Employment and Vocational Research Institute, Survey Committee on Influence of Microelectronics on Employment, "On the Influence of Microelectronics on Employment" (April, 1984)

(6) For studies on the state of introduction of microcomputers into schools and of problems of school education in response to introduction of microelectronics, refer to Hiromitsu Muta, "Education and Training in Japan in the Cybernetic Age," paper presented at the 1st International Jerusalem Convention on Education, Jerusalem, Israel, Dec. 19-23, 1984.

hoping that the boards of education of the prefectures and large cities will hold training classes along the lines of this curriculum.

In Japan's single-tracked type of school educational system, there has been a tendency in recent years towards adoption of a system of double-tracking of students after graduation from high school, and increasing numbers of graduates have been going on to specialized schools of various types whose purpose is vocational training or imparting the abilities needed in actual livelihood. Attention will be focused in the future on the development of this type of training of computer specialists as a so-called "third course," apart from the aforesaid in-company training and public vocational training.

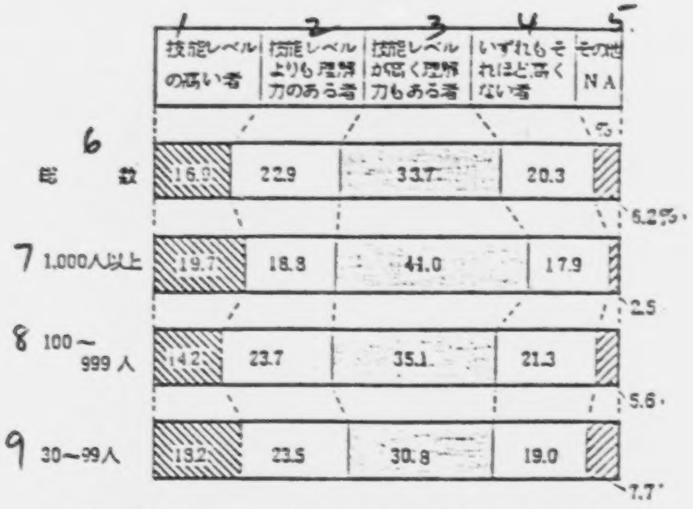


9 注　自動機配置要員のうち，構成比のもっとも
多い層としてあげられた回答比を示す。

Fig.4.1. Age classes of personnel assigned to automatic equipment (component ratio, places of business)

Key:

1. Age 29 or less
2. Age 30-39
3. Age 40-49
4. Age 50 or more
5. Total number
6. 1,000 or more employees
7. 100-999 employees
8. 30-99 employees
9. Note: Of the personnel assigned to automatic equipment, we give the percentage of replies given as the most numerous stratum in the component ratio.



10 注 自動機配置要員のうち，構成比のもっとも多い者としてあげられた回答比を示す。

Fig. 4.2. Levels of skills of personnel assigned to automatic equipment (component ratio, places of business)

Key:

1. High level of skills
2. Ability to understand rather than high level of skills
3. High level of skills and ability to understand
4. Neither level is very high
5. Other
6. Total number
7. 1,000 or more employees
8. 100-999 employees
9. 30-99 employees
10. Note: Of the personnel assigned to automatic equipment, we give the percentage of replies given as the most numerous stratum in the component ratio.

Table 4.1. Education and training provided to workers assigned to processes into which microelectronics equipment has been introduced (%)

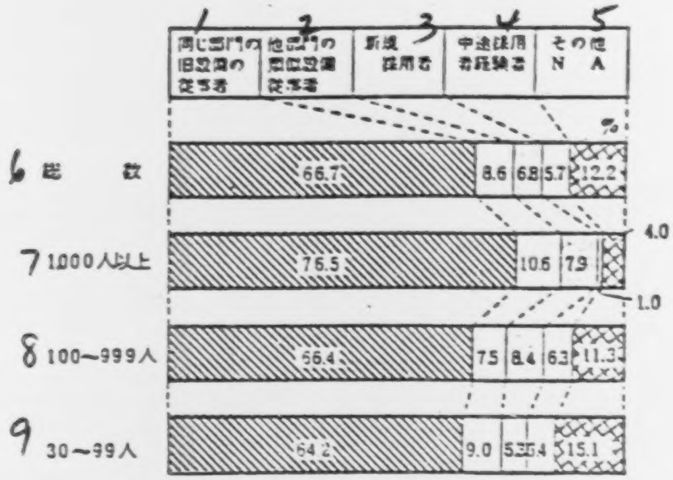
1 事業所規模	2 計	3 行った					9 行わなかった				
		2 計	4 教育訓練の方法（M.A.）				10 計	行わなかった理由 11			
			自社が行う教育訓練 5	設備メーカー，販売会社が行う教育訓練 6	親企業が行う教育訓練 7	その他 8		工程の中で必要な技能は配置転換で確保したから 12	必要な技能は新たな労働者の採用によって確保したから 13	必要な技能はOJTで対処したから 14	必要がなかったから 15
16 計	100.0	60.0(100.0)	(53.5)	(76.7)	(7.8)	(3.0)	40.0(100.0)	(6.7)	(1.7)	(51.5)	(89.1)
17 1.000人以上	100.0	65.8(100.0)	(85.8)	(72.7)	(1.8)	(2.8)	34.5(100.0)	(3.8)	(0.5)	(83.8)	(12.0)
18 300~999人	100.0	63.8(100.0)	(61.4)	(75.5)	(6.6)	(3.0)	86.2(100.0)	(5.8)	(0.7)	(62.5)	(80.8)
19 100~299人	100.0	57.5(100.0)	(44.6)	(77.9)	(8.4)	(3.1)	42.5(100.0)	(7.4)	(2.3)	(43.6)	(45.6)

Key:

1. Sizes of places of business
2. Total
3. Provided
4. Methods of education and training (multiple answers)
5. Education and training provided by the company itself
6. Education and training provided by the equipment manufacturer or the sales company
7. Education and training provided by the parent company
8. Other
9. Not provided
10. Total
11. Reasons why not provided
12. Because the skills necessary in the process had been secured by transferring personnel
13. Because the necessary skills had been secured by hiring new workers
14. Because the necessary skills had already been taken care of by means of on-the-job training
15. Because it was not necessary
16. Total number
17. 1,000 or more employees
18. 300-999 employees
19. 100-299 employees

Note) The data apply to workers who, after the introduction of microelectronics equipment to a process, have continued to be assigned to the process. "Education and training" refers to that during which the workers are away from their jobs for a certain period.

Source of data: Ministry of Labor, "Survey on Technological Innovations and Labor" (carried out in November, 1982)



注　自動機配置要員のうち，構成比のもっとも
10　多い者としてあげられた回答比を示す。

Fig. 4.3. Sources of personnel assigned to automatic equipment (component ratio, places of business)

Key:

1. Employees working with old equipment in same department
2. Employees working with similar equipment in another department
3. Newly hired workers
4. Experienced workers hired at other times than graduation time
5. Others, N.A.
6. Total number
7. 1,000 or more employees
8. 100-999 employees
9. 30-99 employees
10. Note: Of the personnel assigned to automatic equipment, we give the percentage of replies given as the most numerous stratum in the component ratio.

Table 4.2. Methods for educating personnel assigned to automatic equipment (component ratio, places of business) (%)

1 方　　法	2 総　数	1000人 3 以上	100～ 4 999人	30～99人 5
6 総　　数	100.0	100.0	100.0	100.0
7 1. 設備メーカーの研修を受けさせた	65.3	62.3	67.0	65.1
8 2. 社外の研修(1. を除く)に参加させた	23.1	32.2	27.5	17.6
9 3. 自社の技術者等による研修を行った	46.6	80.1	47.6	37.1
10 4. 通信教育を受けさせた	6.1	17.6	7.8	1.8
11 5. 日常の仕事の中で教えた	66.0	83.9	71.2	57.3
12 6. 特に教育はしなかった	3.2	0.0	2.0	4.9
13 7. その他	1.0	2.5	0.8	0.8
14 8. NA	2.8	3.0	3.2	1.1

Key:

1. Method
2. Total number
3. 1,000 or more employees
4. 100-999 employees
5. 30-99 employees
6. Total number
7. 1. Received training by equipment manufacturer
8. 2. Participated in training outside of the company (excluding 1.)
9. 3. Given training by specialists, etc. in the company
10. 4. Took correspondence courses
11. 5. Were taught during everyday work
12. 6. No particular education was given
13. 7. Other
14. 8. NA

Note: Numbers are the percentage of replies with respect to the places of business into which microelectronics machinery and equipment were introduced.

Table 4.3. Processes (into which microelectronics equipment was introduced) classified by state of introduction and by increased or decreased number of hirings in the processes -- Processes in which there were "considerable changes" in hiring were taken as 100 -- (Unit: %)

1 導入状況	2 計	3 採用数		6 採用労働者の種類									
				7 大卒(理工系)		8 大卒(理工系以外)		9 高卒男子		10 高卒女子		11 パートタイマー	
		4 増加した	5 減少した	4 増加した	5 減少した	4 増加した	5 減少した	4 増加した	5 減少した	4 増加した	5 減少した	4 増加した	5 減少した
12 導入工程	(13.0)100.0	37.2	47.2	36.0	7.1	4.7	14.2	37.5	32.6	17.2	25.1	18.5	21.9
13 大部分に導入	(28.0)100.0	41.9	41.1	44.9	6.1	5.0	14.7	43.8	28.7	22.8	25.6	17.7	20.9
14 一部に導入	(11.1)100.0	34.8	49.1	33.3	7.8	4.6	14.1	35.5	33.8	15.5	25.0	18.8	22.8
15 非導入工程	(1.2)100.0	56.3	24.3	23.6	3.5	9.7	4.2	44.4	16.7	26.1	6.9	20.3	[illegible]

Key:

1. State of introduction
2. Total
3. Number of hirings
4. Increased
5. Decreased
6. Types of workers hired
7. University graduates (majoring in physical sciences)
8. University graduates (majoring in subjects other than physical sciences)
9. Male high-school graduates
10. Female high-school graduates
11. Part-time workers
12. Processes into which microelectronics equipment was introduced
13. Introduced into a large part
14. Introduced into a part
15. Processes into which microelectronics equipment was not introduced

(Note) The numbers enclosed in parentheses are the percentage of places of business in which there were "considerable changes" in hiring with respect to the processes in the places of business into which microelectronics equipment had been introduced.

Table 4.4. Changes in school attendance and entrance into schools of higher grades (%)

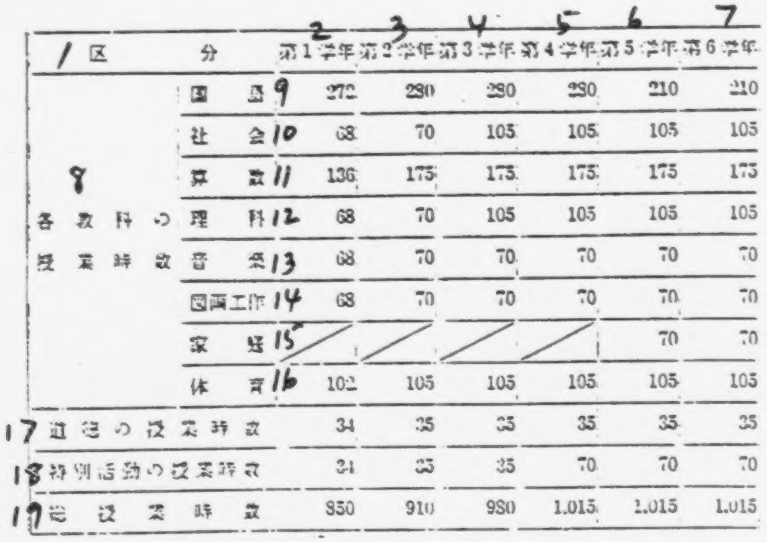
		1 1950年	2 1960年	3 1970年	4 1980年	5 1982年
6 幼稚園		8.9	28.7	53.8	64.4	64.0
7 義務教育 (中学校)		99.91	99.93	99.89	99.98	99.98
高校 8	計 9	42.5	57.7	82.1	94.2	94.3
	男 10	48.0	59.6	81.6	93.1	93.2
	女 11	36.7	55.9	82.7	95.4	95.5
12 大学 (短大を含む)	計 9		10.3	23.6	37.4	36.3
	男 10		14.9	29.2	41.3	39.8
	女 11		5.5	17.7	33.3	32.7
大学院 13	計 9			4.4	3.9	4.5
	男 10			5.1	4.7	5.3
	女 11			1.5	1.6	2.1

14 (「文部統計要覧」より)

Key:

1. 1950
2. 1960
3. 1970
4. 1980
5. 1982
6. Kindergarten
7. Compulsory education (junior high school)
8. High school
9. Total
10. Males
11. Females
12. University (including junior colleges)
13. Graduate school
14. From "Manual of educational statistics" (Monbu tokei yoran)

Table 4.5. Allotment of class time in elementary school curriculum



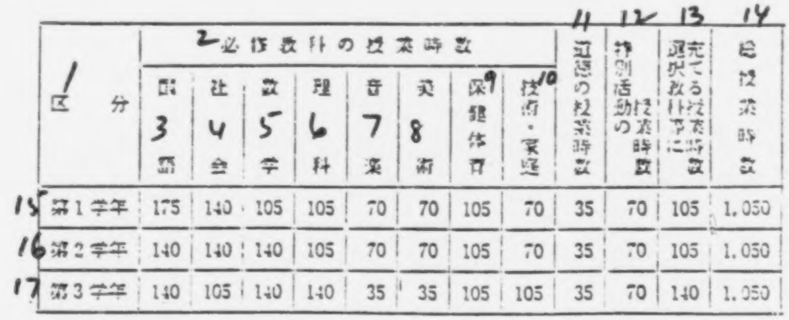
1 区分		2 第1学年	3 第2学年	4 第3学年	5 第4学年	6 第5学年	7 第6学年
8 各教科の授業時数	国語 9	272	280	280	280	210	210
	社会 10	68	70	105	105	105	105
	算数 11	136	175	175	175	175	175
	理科 12	68	70	105	105	105	105
	音楽 13	68	70	70	70	70	70
	図画工作 14	68	70	70	70	70	70
	家庭 15					70	70
	体育 16	102	105	105	105	105	105
17 道徳の授業時数		34	35	35	35	35	35
18 特別活動の授業時数		34	35	35	70	70	70
19 総授業時数		850	910	980	1.015	1.015	1.015

Key:

1. Items
2. First grade
3. Second grade
4. Third grade
5. Fourth grade
6. Fifth grade
7. Sixth grade
8. Class time spent teaching specific subjects
9. Japanese language
10. Social sciences
11. Arithmetic
12. Sciences
13. Music
14. Drawing and handicraft
15. Domestic sciences
16. Athletics
17. Class time spent teaching morals
18. Class time spent in special activities
19. Total amount of class time

(The unit of class time in this table is a period of 45 minutes.)

Table 4.6. Allotment of class time in junior high-school curriculum



1 区分	2 必修教科の授業時数								11 道徳の授業時数	12 特別活動の授業時数	13 選択教科等に充てる授業時数	14 総授業時数
	国語 3	社会 4	数学 5	理科 6	音楽 7	美術 8	保健体育 9	技術・家庭 10				
15 第1学年	175	140	105	105	70	70	105	70	35	70	105	1.050
16 第2学年	140	140	140	105	70	70	105	70	35	70	105	1.050
17 第3学年	140	105	140	140	35	35	105	105	35	70	140	1.050

Key:

1. Items
2. Class time for required subjects
3. Japanese language
4. Social sciences
5. Mathematics
6. Sciences
7. Music
8. Art
9. Health and athletics
10. Skills and domestic sciences
11. Class time spent teaching morals
12. Class time spent in special activities
13. Class time allowed for elective subjects, etc.
14. Total amount of class time
15. First year
16. Second year
17. Third year

(The unit of class time in this table is a period of 50 minutes.)

Chapter 5. Attitudes of Labor Unions

I. Characteristic Features in Japan

The introduction of microelectronics equipment in Japan went extremely smoothly in comparison with the situation in the countries of Europe and America. There are various conceivable reasons for this, but we can no doubt point out, as the most important reason, the fact that the labor unions mounted almost no resistance. Why did the labor unions not oppose the introduction of microelectronics? In the final analysis, it was because the predominant mode of organization of Japanese labor unions is that of the company union centering in permanently employed workers. That is, the major items of interest and the style of activity of a company union are restricted to internal matters concerning company management and pertain to the maintenance and improvement of the working conditions of the permanently employed workers who are the union members. Consequently, under realistic conditions such as the following, the labor unions came to take an attitude accepting the introduction of microelectronics.

First, the companies which first introduced microelectronics equipment were in prosperous industries such as those manufacturing electrical machinery and automobiles, and they had sufficient latitude to absorb within their companies any surplus labor resulting from the introduction of microelectronics.

Second, the permanently employed workers, under the system of seniority wages and lifelong employment, had a strong sense of belonging to the company and could easily cope with reassignments to other workplaces or jobs as a result of the introduction of microelectronics. The unions also did not oppose it as long as the employment of their members was ensured.

Third, the burden of the adjustment of employment in consequence of the introduction of microelectronics fell first on new graduates, part-time workers, temporary workers, and contract workers. The labor unions did not take up the problems of these workers, who are not their members, as tasks of their own union activities.

Fourth, as company unions, the labor unions necessarily had to adopt a co-operative attitude towards the management of their companies so that the latter would not lose out in the competition with other companies brought about by the improved productivity caused by the introduction of microelectronics.

In other words, the attitude adopted by Japanese labor unions towards the introduction of microelectronics is one which has followed in a direct line of progression from the basic attitude which they have adopted towards the technological innovations which had propelled Japan's phenomenal economic growth since the Second World War. However, quite recently, Japanese labor unions also have become more deeply aware of the fact that the situation brought about by the introduction of microelectronics obviously differs qualitatively from a problem which merely follows in a direct line of progression from the technological innovations of the past. That is, it has brought about, among other things, reductions of the total employment, reductions of the number of union members because of changes in modes of employment and work regimens, increasingly serious measures concerning employment of middle-aged and older workers, and health impairments due to work with video display terminals. As their awareness of this situation has been deepened, we can see new movements to deal with the situation, particularly those centering around the organization of industrial labor federations.

II. Results of Surveys on Attitudes of Labor Unions

Concerning the manner in which the labor unions have dealt thus far with the introduction of microelectronics, there is a detailed questionnaire survey (January, 1983) carried out by the Japan Labor Association, an auxiliary organization of the Ministry of Labor [1]. According to it, as is shown in Table 5.1,90.2% of them are in agreement, if we include the replies "agreed in principle" and "it is unavoidable." Although it may be said that union agreement increases as progress is made with introduction of the equipment, it is also believed that, on the contrary,

---

(1) Japan Institute of Labor, "Introduction of microelectronics equipment and the response of labor unions" (Jan., 1984). The survey studied labor unions in the private sector with 100 or more members in the eight prefectures with the largest numbers of labor unions. 50% of these unions were selected at random. The number of unions with effective responses was 604 (effective rate of recovery 14.3%).

progress has been made with introduction of the equipment because the labor unions have given their agreement. Both are no doubt in a state of correlation. Next, according to Table 5.2, there is almost no difference in the attitude of labor unions in different types of industry. As for the size of places of business, more labor unions in large-size places of business tend to adopt an attitude of "agreement in principle." Diametrical differences are seen between the two national centers Sohyo and Domei. While many of the unions belonging to Domei are "agreed in principle," almost all of the unions which are "opposed in principle" belong to Sohyo. Table 5.3 gives the state of labor-management negotiations concerning the introduction of microelectronics equipment. 56.5% replied that they have "had discussions." As for the types of industry, more labor-management negotiations have taken place in the non-manufacturing industries than in the manufacturing industries. This reflects the fact that more progress in introduction of microelectronics equipment has been made in the former industries. As for the sizes of place of business, labor-management "discussions" tend to occur more in larger-sized places of business. However, concerning the contents of the labor-management negotiations, it is clear from Table 5.4 that in most cases the workers have "merely listened to explanations" from the company or have "heard explanations and expressed opinions." It is clear from Table 5.4 that there have been extremely few substantial negotiations in which the workers have "listened to explanations and caused revisions to be made."

The aforesaid survey of the Ministry of Labor [2] also sheds light on the manner in which companies have given explanations to labor and consulted with it upon the introduction of microelectronics equipment. According to it, as is shown in Table 5.5, nearly half of the companies have had explanations and consultations of some type. As for the occasions for the explanations and consultations, in most cases they took place on occasions such as labor-management consultations or social gatherings in the workplaces. The percentage of places of business where the occasion was "collective bargaining" was extremely small. As for the sizes of the places of business, the occasion tended to be "labor-management consultations" more frequently in large-sized places of business, while in smaller-sized places of business the occasion tended more frequently to be social gatherings in the workplace. The items in which the workers were interested in the explanations and consultations are shown in Table 5.6. The items in which they expressed the greatest interest were those connected with transfers and with education and training. These matters were followed by safety and hygiene and by working hours. If we compare the main items of interest according to the size of places of business, we find that in larger-sized places of business

---

(2) See Note (1) of the previous chapter.

there tended to be greater interest in items concerning guaranteed employment, transfers, education and training, and safety and hygiene, while in smaller-sized places of business there tended, on the contrary, to be greater interest in wages and working hours.

III. Concrete Examples of Labor-Management Agreements

The Nissan Motor Labor Union, famous in Japan as a labor union practicing labor-management collaboration, came into the limelight in March, 1983 when it concluded a "Memorandum concerning introduction of new technologies" (ME Agreement) with the company. Its contents are as shown in Table 5.7. Positive recognition was given to the fact that the agreement clearly provides, among other things, for a system of prior consultation before the introduction of microelectronics equipment, for maintenance of the labor conditions, and for guarantees of employment. On the other hand, other aspects of the agreement have drawn criticism, such as the fact that agreement in principle is given to "smooth introduction of new technologies," the fact that the prior consultations are to take place at management consultation meetings rather than collective bargaining, and the fact that it unconditionally recognizes transfers of union members and changes in their job assignments.

Sohyo, which, as mentioned before, adopted a cautious attitude towards the introduction of microelectronics from the very beginning, similarly gives great importance to the system of prior consultations [3]. This is based on sober reflection about the problem of "rationalization" in the past. The reasoning is that "a labor union must act to apply the brakes on technologies which form the basis for production when they are first introduced. If this is not done, the union's efforts to improve working conditions may be fruitless because it will be forced to recognize the fait accompli." However, in its report Sohyo points out that, if a union in a single company independently moves ahead with prior consultations without relation to its parent union, the "destiny" of the company union is such that the system may actually turn into a system of "prior collaboration." "When a union, for the purpose of improving labor conditions, applies strong brakes on the introduction of technologies, this will inevitably result in the company's defeat in competition with other companies where similar brakes had not been applied." Consequently, the operation of the system of prior consultations must start with the establishment of the basis for consultations and the thinking upon which judgments are to be based. These must be established on an industry-wide level or at the level of an industry-wide union organization, transcending the framework of the company union. The reports says that labor unions ought to oppose the introduction of new technologies proposed to company unions by individual employers when such technologies

---

(3) Sohyo Microcomputer Survey Committee, First Report, "Technological innovations and labor unions" (July, 1982)

contradict these minimum standards and thinking about working conditions established on an industry-wide basis. The report also emphasizes the need for industry-wide labor unions (parent unions) to strive to deal organizationally with the industry-wide employers' organizations concerning matters such as improvement of working conditions and guarantees of employment. On the basis of this policy, the National Trade Union of Metal and Engineering Workers (about 170,000 members), a member of Sohyo, prepared the "Model Agreement on Technological Innovations in Microelectronics (Draft)" given in Table 5.8. This model agreement has a number of differences from the aforesaid ME Agreement of the Nissan Motor Labor Union. For example, it includes items concerning agreement with the union about how to deal concretely with all conceivable conditions resulting from the introduction of new technologies, as well as items concerning the agreement of the individual union members about transfers and changes in their job assignments. However, the agreement is still, of course, only in the draft stage.

As mentioned above, apart from the labor unions' attitudes toward the introduction of microelectronics itself and toward the resulting changes in working conditions as a whole, progress is also being made with labor-management agreements about safety and hygienic measures to be taken about health problems which are becoming increasingly serious, such as the aforementioned problem of eyestrain caused by work with video display terminals and the increase of mental stress. Some agreements have included matters such as the improvement of working conditions or guidelines on working standards. We shall omit them here [4].

With the introduction of office automation into companies and the development of the information-processing industry, there has also been an increase in the mode of employment in which workers such as systems engineers or programmers are dispatched from a software company to other firms. For the sake of these software workers, who sometimes tend to be in a state of powerlessness, the "Computer-Related Workers' Union" (Densanro) has recently created repercussions by starting, on the basis of the Employment Security Act, a free-of-charge business of supplying workers. When a company requests this labor union to dispatch personnel such as systems engineers or programmers, it must first sign the Labor Agreement (Table 5.9) prepared by the union as well as its ancillary agreements. By this means, the union aims at intervening in the labor market and at establishing working conditions for the industry as a whole, rather than on a company basis. Densanro at the present time has only 3,000 members and is also merely organized around a number of company unions, but attention is focused on its future as an industry-wide organization with individual memberships and on its ability to penetrate the unorganized software workers, who are supposed to number over

---

(4) Concerning this matter, refer to sources such as "Reader on VDT Labor" published as a supplement of Keizai hyoron (December, 1984).

200,000 or as many as 500,000 in the entire country.

Table 5.1. Basic attitudes of labor unions, classified by state of introduction of microelectronics equipment (%)

·· ···	1 原則として賛成	2 やむを得ない	3 原則として反対	4 これといった考えはない	N.A.	計 5 （実数）
6 計	53.6	36.6	2.0	6.3	1.5	604
7 かなり導入	60.9	33.5	0.4	4.4	0.8	248
8 一部導入	50.0	40.5	2.0	5.6	2.0	306
9 導入なし	40.0	28.0	10.0	20.0	2.0	50

Key:

1. Agreed in principle
2. Unavoidable
3. Opposed in principle
4. No clear idea
5. Total (real numbers)
6. Total
7. Introduced to a considerable degree
8. Partially introduced
9. Not introduced

Table 5.2. Basic attitudes towards introduction of microelectronics equipment (%)

		1 原則として賛成	2 やむを得ない	3 原則として反対	4 これといった考えはない	N.A.	計（実数） 5
6 計		53.6	36.6	2.0	6.3	1.5	604
7 業所	製造業 8	52.7	38.4	1.0	5.9	2.0	391
	非製造業 9	55.4	33.3	3.8	7.0	0.5	213
10 事業所規模	3.000人以上 11	65.4	30.8	—	3.8	—	26
	1.000～2.999人 12	56.5	32.3	1.6	6.5	3.2	62
	500～999人 13	57.0	36.4	1.7	3.3	1.7	121
	300～499人 14	53.2	38.5	1.8	5.5	0.9	109
	100～299人 15	50.4	37.4	2.4	8.7	1.2	254
16 ナショナルセンター	総評 17	32.4	47.2	8.3	10.2	1.9	108
	同盟 18	67.5	27.6	—	3.1	1.8	163
	新産別 19	22.2	66.7	—	11.1	—	9
	中立労連 20	51.2	45.3	—	3.5	—	86
	無所属 21	57.7	33.2	0.5	7.7	1.0	208

Key:

1. Agreed in principle
2. Unavoidable
3. Opposed in principle
4. No clear idea
5. Total (real numbers)
6. Total
7. Type of industries
8. Manufacturing industries
9. Non-manufacturing industries
10. Size of places of business
11. 3,000 or more employees
12. 1,000 - 2,999 employees
13. 500-999 employees
14. 300-499 employees
15. 100-299 employees
16. National centers
17. Sohyo
18. Domei
19. Shinsanbetsu
20. Churitsu Roren
21. Unaffiliated

(Note) The "N.A." replies are omitted from the classifications by size of places of business and by national centers. The same is true below as well.

Table 5.3. Presence or absence of labor-management negotiations concerning introduction of microelectronics equipment

(%)

		1 話し合いがあった	2 話し合いはなかった	N.A.	計（実数）3
4 計		56.5	41.9	1.6	554
5 業種	製造 6	53.5	45.1	1.4	370
	非製造 7	62.5	35.3	2.2	184
8 事業所規模	3,000人以上 9	69.2	30.8	–	26
	1,000～2,999人 10	63.9	31.1	4.9	61
	500～999人 11	58.3	41.7	–	115
	300～499人 12	58.3	39.8	1.9	103
	100～299人 13	52.1	46.1	1.8	219
14 ナショナルセンター	総評 15	53.7	44.2	2.1	95
	同盟 16	57.0	42.3	0.7	149
	新産別 17	75.0	25.0	–	8
	中立労連 18	72.0	26.8	1.2	82
	無所属 19	50.3	47.7	2.0	197
20 ME機器導入状況（総合）	かなり導入 21	63.3	35.1	1.6	248
	一部導入 22	51.0	47.4	1.6	306
23 ME機器への基本的態度	原則として賛成 24	57.9	40.5	1.6	304
	やむを得ない 25	57.0	41.5	1.4	207
	原則として反対 26	57.1	42.9	–	7
	これといった考えはない 27	35.7	64.3	–	28

Key:

1. There have been talks.
2. There have been no talks.
3. Total ((real numbers)
4. Total
5. Type of industries
6. Manufacturing industries
7. Non-manufacturing industries
8. Size of places of business
9. 3,000 or more employees
10. 1,000 - 2,999 employees
11. 500-999 employees
12. 300-499 employees
13. 100-299 employees
14. National centers
15. Sohyo

[Key continued on next page]

Key to Table 3 (cont.):

16. Domei
17. Shinsanbetsu
18. Churitsu Roren
19. Unaffiliated
20. State of introduction of microelectronics equipment (overall)
21. Introduced to a considerable degree
22. Partially introduced
23. Basic attitudes towards microelectronics equipment
24. Agreed in principle
25. Unavoidable
26. Opposed in principle
27. No clear idea

Table 5.4. Contents of labor-management negotiations about introduction of microelectronics equipment (%)

	1 説明を受けただけ	2 説明を受け意見を出した	3 説明を受け修正させた	4 話し合いはない	N. A.
5 1) 導入計画（機器・時期など）	34.8	49.2	4.8	1.6	9.6
6 2) 配置転換	9.9	37.7	6.4	23.0	23.0
7 3) 教育訓練	18.8	47.6	6.7	10.2	16.6
8 4) 操作要員	15.3	43.8	8.6	12.8	19.5
9 5) 安全・衛生問題	7.7	33.5	8.3	28.4	22.0
10 6) 勤務形態（交替制・夜勤など）	9.3	26.2	11.8	29.4	23.3
11 7) 労働時間（休憩時間など）	9.3	28.1	10.5	27.8	24.3

Key:

1. Given explanations only
2. Given explanations and expressed own opinions
3. Given explanations and required modifications
4. There were no talks
5. 1) Plans to introduce (the equipment, the timing, etc.)
6. 2) Transfers
7. 3) Education and training
8. 4) Operating personnel
9. 5) Problems of safety and hygiene
10. 6) Work regimen (shift system, night work, etc.)
11. 7) Working time (rest periods, etc.)

Table 5.5. Places of business (which have introduced microelectronics equipment) classified by size of places of business and by explanations or consultations carried out on the occasion of introduction of equipment utilizing integrated circuits (%)

1 事業所規模	2 計	3 職場懇談会等の場で行った	4 労使協議の場で行った	5 団体交渉の場で行った	6 何も行わなかった
計 7	100.0	21.7	26.1	1.5	50.7
1,000人以上 8	100.0	19.3	40.8	2.3	37.4
300～999人 9	100.0	16.8	34.1	1.6	47.4
100～299人 10	100.0	24.3	20.3	1.3	54.0

Key:

1. Size of places of business
2. Total
3. Took place on occasions such as social gatherings in the workplace
4. Took place on the occasion of labor-management consultations
5. Took place on the occasion of collective bargaining
6. None took place
7. Total
8. 1,000 or more employees
9. 300-999 employees
10. 100-299 employees

Table 5.6. Places of business (which have introduced microelectronics equipment) classified by size of places of business and by main items of interest on the workers' side (Multiple answers, in the main items two answers or less)

(%)

1 事業所規模	2 計	3 雇用保証に関すること	4 配置転換、教育訓練に関すること	5 賃金に関すること	6 労働時間に関すること	7 安全衛生に関すること	8 その他
計 9	100.0	13.1	63.8	7.5	30.7	40.9	10.3
1,000人以上 10	100.0	16.8	74.3	3.7	27.2	50.0	3.4
300〜999人 11	100.0	14.3	67.2	6.3	28.8	44.9	8.8
100〜299人 12	100.0	11.5	59.2	9.2	32.7	36.3	12.9

Key:

1. Size of places of business
2. Total
3. Items concerning guarantees of employment
4. Items concerning transfers, education and training
5. Items concerning wages
6. Items concerning working hours
7. Items concerning safety and hygiene
8. Other items
9. Total
10. 1,000 or more employees
11. 300-999 employees
12. 100-299 employees

(Note) Of the places of business in which explanations or consultations of some sort took place, excludes those in which only explanations were given.

Table 5.7. Memorandum concerning introduction of new technologies (ME Agreement)

Nissan Motor Co., Ltd. (hereinafter called "the Company") and the All-Nissan Motor Labor Union of the Federation of Japan Automobile Workers' Union (hereinafter called "the Union") conclude this Memorandum concerning the introduction of automation, labor-saving equipment and machinery using advanced technologies such as microelectronics (hereinafter called "new technologies").

1. (Purpose)

Based on their common recognition that advances of technology are indispensable for the continued existence and development of business and for the progress of human society, the Company and the Union will co-operate in promoting smooth introduction of new technologies, while taking into consideration the influence on the employees of the introduction of new technologies.

2. (Labor-Management Consultations)

(1) Labor-management consultations upon the introduction of new technologies will be carried out with a spirit of trust and co-operation on the basis of the "Agreement Concerning Management Conferences" (concluded on October 14, 1955).

(2) Before introducing new technologies, the Company will submit to the Union in advance its plans for introducing it, the expected effects on Union members, and the measures it plans to take to deal with them, and will consult with the Union.

3. (Maintenance of Employment)

The Company will not conduct any firings or temporary layoffs on account of the introduction of new technologies.

4. (Maintenance of Working Conditions)

The Company will not demote any positions or lower the wages or working conditions on account of the introduction of new technologies.

5. (Maintenance of Safety and Hygiene)

The Company shall make every possible effort to maintain safety and hygiene in consequence of the introduction of new technologies, and shall formulate measures for this purpose.

6. (Education and Training)

When introducing new technologies, the Company shall conduct the necessary education and training of Union members in the relevant workplaces, in accordance with the individuals' competence and abilities, with respect to acquisition of skills and maintenance of safety.

7. (Transfers and Changes of Job Assignments)

When making transfers of Union members or changing their job assignments on account of the introduction of new technologies, the Company will give sufficient consideration to the individuals' competence and abilities and will give them the necessary education and training.

8. (Effective Period)
(1) This Memorandum shall remain in effect for the period of one year from March 1, 1983 through February 29, 1984.
(2) This Memorandum shall be extended for another year unless either the Company or the Union indicates the wish to amend it by one month before the date of expiration of its effective period, and the same shall apply to the succeeding years.

March 1, 1983

Table 5.8. "Model Agreement on Technological Innovations in Microelectronics (Draft)" (National Trade Union of Metal and Engineering Workers, August 1983)

(Preface)

The Company and the Union conclude this Agreement concerning the introduction of advanced technologies, chiefly microelectronics, and of facilities, equipment and systems using them (called "new technologies").

(Purpose of Agreement)

Article 1. The Company and the Union will take sufficient care so that the introduction of new technologies will not cause disadvantages to the Union members and will both deal with it co-operatively for the purpose of guaranteeing employment and maintaining and improving the working conditions.

(Confirmation of Prior Consultation)

Article 2. In introducing new technologies, the Company will notify the Union and consult with it during the stage of planning for introduction. The Company will disclose all the conditions which will be changed as a result of the introduction of the new technologies, such as the envisioned work and amount of work, job assignments, workplace environment and assignment of personnel, will consult with the Union about concrete measures to deal with them, and will introduce them after agreement has been reached.

(Confirmation of Efforts to Create and Guarantee Employment)

Article 3. The Company will conduct no firings or temporary layoffs on account of the introduction of new technologies. The Company must also make efforts to create employment as a result of the introduction of new technologies.

Article 4. The Company will make efforts to shorten the working hours in order to take advantage of the labor-saving effects of the new technologies. The Company will not demote any positions or lower the wages or working conditions on account of the introduction of new technologies.

(Transfers and Changes of Job Assignments)

Article 5. If the Company transfers Union members or changes their job assignments on account of the introduction of new technologies, the Company will obtain the agreement of the individuals and of the Union. It will also give them the necessary education and training. Six months after the transfers and changes of job assignments, the suitability of the individuals will be investigated. If they are found to be unsuitable, the general rule is that they will be returned to their original jobs. If their original jobs (or job assignments) are no longer available, they will be reassigned to a suitable workplace (job assignment), respecting the wishes of the individuals.

(Education and Training)
Article 6. The Company shall give Union members basic education and training in the new technologies, and those who desire it will be dispatched to technical training agencies outside of the Company. The techniques, skills and qualifications acquired by this education and training will not be directly related to wages and working conditions. Special considerations, with reference to matters such as the contents of the education and the hours of education and training, will be incorporated in the education and training given to older workers who have difficulty in adapting.

(Safety and Hygiene)
Article 7. The Company will make every possible effort to maintain safety and hygiene in consequence of the introduction of new technologies, and shall implement safety education of the Union members, obtaining the co-operation of specialists and others. To prevent nervous impairments, etc. resulting from the characteristics of the new technologies, the Company will consult with the Union on each occasion and make decisions concerning regulations on working time, changes of the working regimen, etc. as necessary.

Table 5.9. Labor Agreement

____________________ (hereinafter called A) and the Computer-Related Workers' Union (Densanro) (hereinafter called B) hereby conclude the following supply contract as established in Article 5 of the Employment Security Act.

Article 1. A can at any time receive and use a supply of B's union members.

Article 2. B will not request from A any recompensation for supplying B's union members to A.

Article 3. The basic wages, fees, working time and other working conditions are to be determined on each occasion by consultations between A and B.

Article 4. Cancellation Fees

If union members become unable to work because of reasons for which A is responsible, A shall pay a cancellation fee equal to 60% of the basic wages.

Article 5. Auxiliary Conditions Concerning Wages

If B's union members are regarded as having abandoned work without appropriate reason, the members' wages may not be paid, after consultations between A and B.

Article 6. Payment of Wages

The wages of B's union members shall be paid directly by A to B's union members.

Article 7. Negotiating Rights

Negotiating rights concerning the working conditions of B's union members shall all belong to B.

Article 8. Social Security

A shall apply social security to the union members supplied by B. The details are to be determined by consultation between A and B.

Article 9. This contract is to go into effect on _______ and is to remain in effect for the period of one year. It shall remain automatically in effect for one more year after that unless there has been a notification concerning the revision or abolition of this contract.

Date: ____________________

Chapter 6. Conclusion

Thus far we have reviewed the state of progress of the technological innovations based on microelectronics in Japan and various aspects of their impacts on employment on the basis of various survey data. Let us here describe the various problems involved here and the opinions which have been expressed about them.

1. Since the introduction of microelectronics is a new industrial revolution which brings about qualitative changes in the socio-economic structures, it is only natural that it should cause friction. However, the introduction of microelectronics has been accepted in Japan with relatively little resistance as something following in a direct line of progression from the technological innovations which began at the end of the 1950s. A number of factors can be pointed out in this respect.

(1) First, the rate of growth of the Japanese economy has not weakened. The technological innovations centering around automation which advanced rapidly during the 1960s brought about phenomenal improvements of productivity and accelerated the rapid growth of the economy. There were far-reaching changes in the structure of the economy, phenomenal expansions of the secondary industries and increases of employment. The labor market entered a period of manpower shortages, and the shortage of skilled labor became acute, especially in smaller businesses. Since the rate of

population increase dropped after the Second World War and Japan entered a period when a higher proportion of the population had received a higher education, there was a shortage especially of young workers. Microelectronics equipment was greeted joyfully as a means of dissolving future shortages of manpower. The performance characteristics of microelectronics equipment improved phenomenally, and the prices dropped astonishingly. As a result, automation technologies which had previously been monopolized exclusively by a few large companies were now made available to smaller businesses as well. Microelectronics equipment was greeted eagerly like rainfall during a dry season and spread into all industries and all companies. One surely must not forget that the shortage of manpower, chiefly of young workers and of skilled workers, was part of the background against which introduction of microelectronics was accepted with relatively little resistance.

(2) One must point out that a second factor explaining why the introduction of microelectronics equipment has proceeded relatively smoothly thus far in Japan was the fact that changes in the industrial structure occurred on the occasion of the Oil Shock. The changes involved a shift towards conservation of natural resources, prevention of environmental pollution, and a shift towards industries with high values added. Maintenance of the export level was an imperative task for Japan, which is poor in natural

resources and which can survive only as a fabricating and trading country. Measures against environmental pollution were another urgent for Japan, with its population densely congested in a small land area. Microelectronics technologies were combined with mechanics, and various applied technologies were developed. Microelectronics technologies were widely introduced in Japan because it was believed that they would meet the nation's requirements of conservation of natural resources, conservation of energy and prevention of environmental pollution.

On the other hand, the automation technologies of the past were technological innovations based on the premise of mass production. Therefore, once rationalization of the manufacturing processes reached a certain stage, it became meaningless in terms of price competition, and mass production merely led to needless reductions of the rate of profit. For this reason, as a result of introduction of microelectronics equipment, companies began to incorporate into their strategy the manufacturing of small amounts of a wide variety of products with high values added. Companies vied with each other to introduce microelectronics equipment, which, thanks to their compact sizes, flexibility and systematization, made it possible to manufacture small numbers of a wide variety of products. In addition, the characteristic features of microelectronics equipment, which make it possible to manufacture small numbers of large numbers of products, along with the drops in their prices, accelerated the introduction of microelectronics into smaller businesses.

(3) The introduction of microelectronics equipment went forward relatively smoothly in Japan because exports were expanding. As we saw above, microelectronics equipment was introduced exclusively because of considerations of cost (labor-saving, quality improvement), and the demand for it expanded because it made it possible to manufacture good-quality products inexpensively. Products utilizing microelectronics such as automobiles, electronic machinery (typically color television sets and video tape recorders) and precision machinery made especially large inroads on world markets and gave an additional impulse to the progress of introduction of microelectronics in Japan.

(4) Finally, as one of the reasons why there has been relatively little resistance to the introduction of microelectronics in Japan, one must mention the fact that the labor unions have adopted a collaborative attitude. Because of the makeup of the company unions which are characteristic of Japan, the labor unions themselves are in a position where they must, in the final analysis, agree with the introduction of microelectronics equipment in order to enable the company to survive in the competition with other companies. However, even though the unions are company unions and even though the introduction of microelectronics

equipment is essential for the survival of the company, the unions would no doubt struggle, even to the extent of going on strike, if it were to result in the loss of large numbers of jobs or in far-reaching deterioration of the working conditions. This is clear from the serious frictions which followed after a number of industrial shifts which occurred in the past (for example, the Mitsui Miike dispute of 1960, the seamen's dispute of 1972, or the Mitsubishi Heavy Industries Sasebo dispute of 1978-80). Nevertheless, the experiences accumulated during the introduction of automation during the 1960s were utilized in the introduction of microelectronics equipment, and the prior consultation system was used. Many unions approved of the introduction of microelectronics equipment under the condition that there would be a prior consultation system from the planning stage and a prior agreement system with the guarantee of full employment and provisions for transfers and retraining. For example, the Asahi Shimbun started using a computer system in its new building in September, 1980. Prior consultations between labor and management were carried out continuously at every stage from the planning stage to the placement of orders for the equipment, the installation, the trial runs, partial operation and full operation. Consultation meetings were reportedly held 250 times during a 9-year period [1].

There are some other reasons which could be mentioned as factors explaining why the unions recognize the introduc-

---

(1) Miyagi, Shinsuke, "Realization of workplace demands is the condition for introduction of new technologies," Kikan rodoho (Labor law quarterly), no. 123, p. 63.

tion of microelectronics equipment with relatively little resistance. For one thing, the introduction of industrial robots started with dangerous work and "dirty" work in undesirable conditions such as welding and painting. The percentage of automation has been increased gradually in the form of replacing the automation of the past, rather than being a direct substitution for human labor. Furthermore, the technological innovations of the past have not had a very large impact on employment problems. A number of unions have concluded so-called ME Agreements and have stated clearly the union's attitude about the introduction of microelectronics equipment. However, it is noteworthy that recently they have come to demand clearly that the achievements gained by the introduction of microelectronics equipment should be distributed among the workers as well.

In addition, one must point out that small-group activities such as quality-control circles have played a large role in the introduction of microelectronics equipment in Japan. Since the microelectronics equipment is actually operated by the workers in the workplace, microelectronics equipment cannot be introduced into the production processes without the understanding and co-operation of these workers. Microelectronics equipment became firmly rooted in the workplace through various types of in-company and external training (on-the-job training, OFF-IJT) and through improvements and suggestions in quality-control activities. If the prior consultation system was the occasion for understanding and co-operation at the beginning of the introduction of microelectronics equipment, the small-group activities were the occasion for understanding and co-operation during the process of introduction of microelectronics equipment. One can even state that both of them made up both sides of the coin in companies which introduced microelectronics equipment.

The fact that microelectronics was accepted relatively smoothly in Japan may be attributed to the various background factors outlined above. In a sense, one may say that Japan was fortunate in having such a background.

2. In studying the influence of the introduction of microelectronics equipment on employment, it is necessary to consider the matter from both the qualitative and the quantitative aspects of employment.

First, concerning the impact on the quantitative aspect of employment, the various surveys concerning "Microelectronics and employment" which have been made thus far have not produced any concrete results which would indicate that the introduction of microelectronics has had an adverse effect on employment. For example, according to a survey made by the All-Japan Federation of Electric Machine Workers' Unions (Denkiroren) ("Influence of microelectronics technologies on employment and labor in the electrical machinery industry," October, 1982) [2], between 1978, when microelectronics equipment began to be introduced on a large scale into the manufacturing processes, and the time of the survey, 43.7% of the places of business said that the number of regular employees had "increased," while 31.7% said that it had "decreased." In the previously cited survey made by the Ministry of Labor ("OA"), the numbers of workers in privately owned businesses with 100 or more employees as of the end of October, 1983 had "increased" in 43.2% of the companies as compared with 5 years before, and it had "decreased" in 27.0% of them. The report presented by the Japanese delegation to an international conference sponsored by the OECD on "The influence of microcomputers on employment" contained the following assessment: "If we evaluate at the current stage the influence of microcomputers on employment, we can say that, at least, there has been no resulting unemployment. On the contrary, there is greater activity in the hiring of new specialists. Therefore, one may consider it to be a plus from the quantitative standpoint." [3] The "Kagaku Gijutsu to Keizai no Kai," which is the Japanese secretariat of the Club of Rome, also said, in a survey report finished in May, 1982, that technological innovation is a positive factor both in developing the economy and in increasing employment.

On the other hand, there are those who espouse a pessimistic view of the employment situation. Let us suppose,

---

(2) Denkiroren chosa jiho (Bulletin of surveys by All-Japan Federation of Electric Machine Workers' Unions), no. 182.

(3) Inose, Hiroshi, comp., "Does the microcomputer cause unemployment? Influence of microelectronics on employment," p. 59.

argues one author, that microelectronics has been introduced into every nook and cranny of industry and is exhibiting its labor-saving effects to the maximum degree. In that case, there will be a 50% surplus of personnel in the manufacturing industries and a 30% surplus in the service industries. If these percentages are translated into the numbers of employees as of 1980, the number of surplus personnel will amount to 8,050,000. If we combine these with the 500,000 employees who will be eliminated as a result of rationalization of government departments (25% surplus), the total will reach 8,550,000. Since the rate of unemployment as of March, 1982 was 2.26%, and the number of fully unemployed was 1,470,000, there is the possibility that microelectronics will result in a period of massive unemployment. The author of this prediction says that these figures unexpectedly agree with a recent report by Forecasting International, an American forecasting agency, which says that "if Japanese industry continues to promote robotization aiming at further improvements of productivity, Japan's unemployment rate will rise from its current 2.5% to 12% during the 1990s." [4]

Since the dissemination of microelectronics means the rationalization and automation of the manufacturing process, it necessarily results in decreased employment, but at the same time it also causes increased employment by the creation of new markets. Observers of the effects of

---

(4) Masuda, Yoenji, Sentan shakai (Advanced society), pp. 77-80.

microelectronics on employment are divided into pessimistic and optimistic camps depending on how large an estimate they give to the amounts of decreases and increases of employment. However, it is extremely difficult to predict the future, since trends in the technological environment and in the economic situation will cause differences in the factors eliminating or promoting employment. Moreover, it is nearly impossible to separate out only the economic effects of the introduction of microelectronics and to view them in isolation. For the most part, these effects are deeply interlaced with the fluctuations of the macroeconomy as a whole. Consequently, neither pessimism nor optimism is very meaningful as a prediction of the future. The only thing which one can say with certainty is that, even though the introduction of microelectronics has operated thus far in Japan as a positive factor in promoting employment, there is no convincing evidence proving that this desirable situation will continue in the future, if one considers the severe politico-economic circumstances such as today's difficult economic environment and the intensified technological competition and international trade frictions expected in the future.

---

3. Even though microelectronics has thus far not had any serious impact on employment, such as by causing unemployment, we must point out that the changes in the makeup of the labor force in companies and the changes in hiring point to the existence of rather serious problems.

(1) When microelectronics is introduced into manufacturing departments as well as office departments, there is naturally a need for specialists in software development who have a knowledge of matters such as electronics, mechanics and software technology. Even if large numbers of robots are introduced into the manufacturing processes, there will still remain non-manufacturing work such as programming, teaching tasks to robots, operation, monitoring and routine maintenance. Therefore, there will be increased demand for these specialists engaged in information-system work. The seller's market for information-processing workers, chiefly new graduates, will still continue.

Nevertheless, large numbers of unskilled workers, who played the main role in manufacturing work in the past, will be driven out by microelectronics. In the manufacturing workplace, labor will become bi polarized into, first, a small number of workers engaged in extremely simple tasks left behind by automation or exclusively in monitoring work, and second, specialists performing intellectual work on a high level. In the office departments also, there will be far-reaching decreases of the amount of ordinary office work, which will be divided into information-processing work (databases) and specialized judgmental work of utilizing databases at a high level. These changes in the makeup of the workforce in the manufacturing processes and in places of business have already appeared clearly in the Ministry of Labor surveys which we have already seen. These survey reports also make it clear that the effects of the introduction of microelectronics have been concentrated in two areas: female workers, and middle-aged and older workers.

(2) Large numbers of female workers were active in some industries, such as the electrical machinery industry, just as they had once been active in the textile industry. However, the situation has changed greatly because of the effects of the introduction of microelectronics. "Medium-range employment projections for the electrical machinery industry" (November, 1981), a report published by the All-Japan Federation of Electric Machine Workers' Unions (Denki-roren), states that "in consumers' electrical machinery, decreases of 43.7%, amounting to slightly more than 90,000 employees, have been indicated for a six-year period, and it is forecast that the employment problem in this sector will

reach the most difficult situation of any in the electrical machinery industry." For example, the three largest manufacturers of consumer electrical appliances had 25,779 female workers in March, 1970. By March, 1980, their number had dropped to 13,971, a decrease of 46%. On the other hand, male workers had increased by 5%. Robots had advanced into the workplace replacing the female workers. Since there was increased work for the male workers in assembling software or in routine maintenance of microelectronics equipment, the number of young, newly-graduated workers had increased. However, the numbers were reduced by means of attrition (not hiring replacements for workers who had resigned by reason of marriage, etc.) and by refraining from new hirings, and the problem of firings did not arise. When we examine the changes in the numbers of workers in all industries, both by places of business and by companies, we find that the females have a lower rate of increase and a higher rate of decrease than males. We have already seen this tendency in the surveys made by the Ministry of Labor. In the past, large numbers of female workers were mobilized in the workplace as a result of the simplification of labor caused by technological innovations. Now the technological innovations brought about by microelectronics have either narrowed the range of workplaces traditionally assigned to females or are eliminating these workplaces entirely. Of course, a number of new workplaces have been opened up for women as a result of the introduction of microelectronics. For example, the processes of assembling semiconductor ICs were once labor-intensive processes requiring large numbers of manually dexterous female workers. Electronics companies dispersed their plants to areas such as Kyushu and Tohoku in search of inexpensive labor power. However, these assembly processes soon changed into entire plants where semiconductor ICs were manufactured integrally. The semiconductor industry changed to an equipment-intensive industry with the most up-to-date production facilities, and now only a few female workers are assigned to some sections which are bottlenecks in the production line.

Office automation also is delivering a direct blow to female workers. Not only workers engaged in general office work, but also those engaged in work with mainframe computers such as operators and keypunchers, have lost their work thanks to the appearance of personal computers and on-line terminals. In the 1970s, female workers who lost their jobs because of technological innovations in the manufacturing industries were able to move into the tertiary industries. However, in the 1980s, microelectronics has penetrated even into the finance and insurance industries and the wholesale and retail industries, and there is no longer anywhere for female workers to go. This has appeared as a serious job shortage for recent female high-school graduates and university graduates majoring in liberal arts. Female workers are thronging to the few remaining positions open for women, and the competition for these jobs is lowering their wages. The time seems to be coming when we will have to take a close look at the impact of microelectronics on employment, which is first appearing in serious form in the female workers, and the government will have to study promptly national policies for guiding female students into science courses in schools, for providing them with vocational training, and for taking vigorous measures for creating employment in the "information society" of the future.

(3) Many surveys have established that the impact of microelectronics has strongly affected, not only female workers, but also middle-aged and older workers. For example, the Prime Minister's Office in 1980 made a survey of the labor force, studying the age composition of skilled and unskilled workers in manufacturing processes. The percentages were: 30 years of age or less, 22.7%; 30-40, 42.0%; and 45 years or older, 35.2%. On the other hand, the Vocational Training Research Center in 1982 made a "Survey of Technological Innovations, Increasing Age and Effective Utilization of Manpower (Survey of Individuals)" in which it studied the age composition of workers using microelectronics equipment. It found that 23.8% of such workers were 45 years or older. The 1980 Census figures for the age composition of information-processing specialists show that an even smaller percentage (2.1%) of them are 45

years or older. The Employment and Vocational Research Institute made a "Fact-finding Survey of Effective Utilization of Labor Force in Companies" (December, 1981 - February, 1982). It found that transfers had taken place in workplaces into which microelectronics equipment had been introduced in about 40% of the companies. In 27.5% of the companies, workers had been transferred from the workplaces into which the microelectronics equipment had been introduced to other workplaces; in 6.8% of them, they had been transferred from other workplaces to the workplaces into which the microelectronics equipment had been introduced; and in 6.4% of them, both of these transfers had occurred. However, it is noteworthy here that the workers transferred from the workplaces into which the microelectronics equipment had been introduced to other workplaces had the following age composition: in 38.3% of the cases, they were in their "twenties"; in 49.6% they were in their "thirties"; in 44.8% they were in their "forties"; and in 16.9% they were in their "fifties." On the other hand, exactly the opposite trend was seen in the case of the workers transferred from other workplaces to the workplaces into which the microelectronics equipment had been introduced had the following age composition: in 50% of these cases, they were in their "twenties"; in 60.4% they were in their "thirties"; in 29.2% they were in their "forties"; and in 6.3% they were in their "fifties." The statistics make it clear that when microelectronics equipment is introduced middle-aged and older workers are transferred to other workplaces, and younger workers are transferred on a priority basis from other workplaces to those into which the microelectronics equipment is introduced.

The increasing age of the working population in Japan is a problem which has been pointed out for some time. If we compare the data for 1975 and for 1985, we find that the working population aged 15-29 and the working population aged 30-39 both decreased by 3% and 5%, respectively, while the working population aged 40-54 increased by 30% and that aged 55-64 increased by 60%. It is also predicted that middle-aged and older workers (45 and older) will make up more than 40% of the working population by the year 1990. Middle-aged and older workers generally earn higher wages than young workers. This is because wages in Japan are paid by a seniority system distinctive to the Japanese labor-management relationship. However, in the past this was a wage system which corresponded to the length of experience in the company and to the degree of skills. It also corresponded to the older workers' responsibilities as middle-level management employees. However, the situation has changed with the introduction of microelectronics equipment. Microelectronics has made the skills and experience of the past meaningless, and middle-level management has become unnecessary. Young workers are better able to adapt to new technologies. Middle-aged and older workers have been ejected from workplaces into which microelectronics equipment was introduced and have been transferred or loaned to workplaces or affiliated companies able to receive them. The composition of the workforce is becoming more and more problematic in that the companies, on one hand, are studying the introduction of microelectronics equipment _because of_ the shortage of young workers, while on the other hand, once the companies begin to introduce microelectronics, they hire fewer young workers, with the result that their employees tend to become older and older. The Vocational Training Research Center's "Survey of Technological Innovations, Increasing Age and Effective Utilization of Manpower" (March, 1982) states, on the basis of the survey results, that "on the whole, in the measures currently in effect, a higher weight is being given more to defensive measures such as finding workplaces able to receive middle-aged and older workers, establishing new workplaces and transferring them to them, or correcting seniority pay to allow for the decreased efficiency. It would seem that measures aimed at positive utilization of the abilities of the middle-aged and older workers remain as tasks for the future in most cases." Since the aging of the working population is a structural change which will continue in the future, it is necessary for Japan to move rapidly to establish a national policy to deal with middle-aged and older workers, including measures for their education and training.

(4) We have already seen that microelectronics equipment has been making remarkable inroads in small businesses. For example, robots for arc welding have been introduced into small businesses at a rate of 90%, and larger numbers of numerically controlled machines also have gone into small businesses, judging from the percentages of employees. The small businesses have made the decision to introduce microelectronics equipment for the purpose of making up for the shortage of skilled workers and young workers. One may perhaps say that, thanks to their greater organizational flexibility and ability to make quicker decisions, smaller businesses have been able to deal more flexibly and quickly with the application of microelectronics. Many small businesses have been able to enhance the precision and quality of their products and to cut their costs because they have moved energetically to introduce and systematize microelectronics equipment. A number of small businesses have also grown into excellent medium-size companies which are highly respected internationally as well as domestically.

Nevertheless, these increased productive forces are possible, for structural reasons, only under the precondition that competition between companies has led to a weeding-out process by natural selection. The companies which were late in introducing microelectronics equipment lost out in competition in the market and fell into a business slump.

Even though there was an unemployment rate of only about 2.5%, and a definite rate of economic growth is maintained, the number of bankruptcies among small businesses is not small. Moreover, along with the introduction of microelectronics, large businesses have increased the percentage of work performed inside their companies. In the past, the large companies used smaller contractors as a regulating valve to deal with business fluctuations. However, with the introduction of microelectronics, a system grew up by which it was sufficient to put the equipment out of use as soon as there was a slump, and the smaller contractors were gradually dispensed with. Previous automation had been restricted to large companies. However, the introduction of microelectronics at this time is moving forward at the same time in large and small companies, and small companies which were too late in dealing with the technological innovations were weeded out by the process of natural selection. The small companies until now had, in a certain sense, formed a separate labor market from the large companies and had functioned as a receptacle for receiving the workers ejected from large companies by technological innovations, middle-aged and older workers, and workers who had retired at retirement age. The impact of microelectronics will inevitably be felt after the demise of these small companies, who had received these workers, resulting in serious unemployment, chiefly among the middle-aged and older workers.

4. The introduction of microelectronics has exerted an impact on Japanese labor-management relationships and employment practices in a number of ways. Let us here point out a number of the points which we have seen thus far:

(1) A characteristic feature of microelectronics is that it penetrates rapidly and simultaneously without regard to the sizes of industries and companies. For this reason, there is naturally a shortage of specialists. Almost all companies were forced to rely on personnel dispatched from software companies. The software industry is growing rapidly, but tasks such as programming are being done by dispatching personnel, chiefly young workers. In many cases, these workers suffer under adverse working conditions, being rushed to meet deadlines and forced to work overtime until late at night day after day. Workers are used and discarded so callously that it is even being whispered that the age of mandatory retirement in the software industry is 35. The majority of these information-processing workers are intellectual workers who are university graduates, but little progress has been made in organizing them in labor unions because they are isolated and dispersed in their work and because many of them are specialists with a "loner" type personality. They are engrossed in their work because of their own intellectual interests, and in many cases they voluntarily stay to work overtime.

(2) The impact of microelectronics appears in the work-

place as changes in the working hours. The introduction of microelectronics to manufacturing processes means a high degree of automation involving larger sizes, faster speeds and continuous production, and 24-hour continuous operation is being adopted. Workers are being assigned accordingly, with a three-shift or two-shift system being adopted. Even when the machinery is shut down at night, maintenance work such as inspection and repair is done late at night. Microelectronics equipment may have liberated the workers from manual toil and from dangerous and harmful work. However, it has not liberated them from time. In nearly all fields problems have arisen demanding changes in the conventional systems of working time, such as overtime work, late-night work and the shift system.

(3) As has been described already, the introduction of microelectronics equipment made conventional skills unnecessary. In Japan new graduates have acquired skills by vocational training within the company. On-the-job training in the workplace was the basic method by which skills were transmitted. It was thought that workers acquired more experience and skills the longer they had continued to work in a company, and order was maintained in the workplace by a system in which middle-aged and older workers were paid higher wages than younger workers. However, the introduction of microelectronics equipment has changed these circumstances. The ejection of middle-aged and older workers from

the workplace means the collapse of the props which had supported order in the workplace in the past. This is another way in which Japanese employment practices are being subverted.

5. The development and introduction of microelectronics equipment was supposed originally to begin with the elimination of shortages of labor and the liberation of workers from dangerous and harmful work. In accordance with the "logic of capital," the improvement of productivity changed into a goal in itself, and this led to production lines manned by robots and unattended factories. Now we are about to reach a system which deals with business fluctuations by adjusting the numbers of machines in operation, rather than by adjusting the numbers of workers employed. Moreover, the introduction of microelectronics equipment is having a many-sided impact on employment even in Japan, where it is said that it has moved ahead relatively successfully. However, companies are in a situation where they will lose their power to compete economically and will become unable to survive if they hesitate to introduce microelectronics equipment. One may say, on one hand, that this is the role assigned by destiny to technological innovations. On the other hand, the problems posed by the introduction of microelectronics equipment, since they go far beyond the confines of a single country and involve the entire world economy,

would seem to have such a far-reaching influence that they cannot be left to take their own course. Unless control systems are established promptly for them, technological innovations proceeding at such an accelerated rate are particularly dangerous because it is impossible to predict clearly where they may lead.

For example, if we restrict the problems to Japan alone, we can see that distributing the results attained as a result of the introduction of microelectronics equipment in the form of a shortening of working time and of far-reaching increases of the wages of part-time workers and workers dispatched from software companies is connected in a way with the idea of "work sharing" and would be helpful in guaranteeing employment. Since labor unions are organized on a company basis in Japan, they are not necessarily functioning effectively as a system for controlling the introduction of microelectronics equipment. It will no doubt be necessary for nation-wide industrial labor unions or national centers to make powerful efforts to promote the organization of a system of industry-wide or nation-wide labor-management consultations.

On the international level also, it is desirable that a system for controlling microelectronics be organized promptly with international co-operation, for example through organizations such as the ILO.